

DISEASES OF THE STOMACH
AND
THEIR SURGICAL TREATMENT

ROBSON & MOYNIHAN

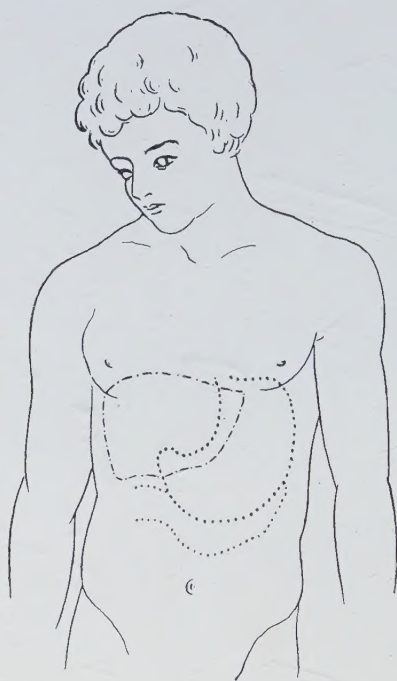
Charles S Hamilton

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THE NORMAL POSITION OF THE STOMACH.

DISEASES OF THE STOMACH

AND THEIR

SURGICAL TREATMENT

BY

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LONDON
BAILLIÈRE, TINDALL AND COX
8, HENRIETTA STREET, STRAND
[PARIS AND MADRID]

1901

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Charles S. Hamilton

To

OUR COLLEAGUES ON THE STAFF

OF THE

GENERAL INFIRMARY AT LEEDS

WORKS BY MR. MAYO ROBSON.

A GUIDE TO THE INSTRUMENTS AND APPLIANCES
REQUIRED IN VARIOUS OPERATIONS.

CASELL AND CO.

ON GALL-STONES AND THEIR TREATMENT.

CASELL AND CO. 1892.

DISEASES OF THE GALL-BLADDER AND BILE-
DUCTS. Second Edition.

BAILLIÈRE, TINDALL AND COX. 1900.

BY MR. MOYNIHAN.

RETROPERITONEAL HERNIA.

BAILLIÈRE, TINDALL AND COX. 1899.

P R E F A C E

THERE can, we think, be no need for an apologetic preface to a work dealing with the 'Surgery of the Stomach.' This branch of our art has made so great advances within the last few years that a review of its progress seems both fitting and desirable.

The present work took its origin in the Hunterian Lectures delivered by one of us at the Royal College of Surgeons of England in 1900. The attention called to the subject by those lectures resulted in a large increase in our experience of the various gastric conditions amenable to surgical treatment. To deal fully with subjects lightly touched upon in the lectures, to expand, in fact, those lectures into a volume, was a work which the lecturer unaided would have been hard pressed to accomplish in the space of time within which it was felt desirable to publish the volume. A collaboration seemed therefore desirable, and as we had been associated in hospital work more or less closely since 1887, when our relative positions were those of Honorary Officer and House Surgeon, the present collaboration seemed both natural and appropriate.

For every statement made in the book we jointly hold ourselves responsible. The whole work has undergone a careful revision by both of us, and much of it has been frequently discussed while in preparation and after completion.

That the aid of surgery must be called in to deal with

both simple and malignant disease of the stomach, in the future far more often than in the past, seems inevitable. We consider that we are justified in saying that our joint record shows that the risks of such surgery are far less than has been generally believed.

In support of this statement, one of us, in a series of over 200 operations on the stomach, can refer to the last seventy-five consecutive operations in his private clinic, including malignant and simple cases, with only one death (and that from accidental perforation on the twelfth day), and the other can point to a consecutive series of forty-seven hospital and private cases, with three deaths.

We take this opportunity to thank Dr. W. MacGregor Young, M.A., for his valuable assistance in illustrating the work by original drawings and diagrams, which will be found of great service in elucidating the text, and one of us also accepts the occasion of the preface to acknowledge the great help he received during the preparation of the Hunterian Lectures from Dr. Farquhar Macrae, now on the staff of the Western Hospital, Glasgow, but at that time assisting us in his private clinical work.

LEEDS.

A. W. M. R.

B. G. A. M.

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SURGERY OF THE STOMACH

CHAPTER I

ANATOMICAL CONSIDERATIONS—DIAGNOSIS

THE stomach, when normal, is a somewhat pear-shaped hollow organ situated in the epigastric and left hypochondriac regions, the larger part (fully two-thirds) being under cover of the liver and diaphragm, but the anterior surface in its lower part lying against the anterior abdominal wall. Its general axis is not quite vertical, but inclined obliquely, the cardiac orifice being on the left of the tenth dorsal vertebra, while the pyloric outlet is situated on the right of the eleventh or twelfth dorsal vertebra, about an inch to the right of the middle line, and nearer the anterior abdominal wall. The channel of entrance into the stomach is vertical, but that of exit is directed downwards, backwards, and to the right.

Between the cardiac and pyloric orifices the stomach is curved along both its upper and lower borders. The upper border, known as the lesser curvature, between 3 and 4 inches in length, is slightly concave, looks upward and towards the right, and is nearly all situated to the left of the middle line. The greater curvature is about three times the length of the lesser, and, except for a small part near the pylorus, is convex throughout. Tracing it from the cardiac orifice, it is found to arch upwards to the left for about 2 inches; it then sweeps downwards and to the right until it reaches the middle line, where it again changes its direction and passes upwards, to the right and slightly forwards, till it reaches the pylorus. When the stomach is filled with

air under medium tension, the lower border reaches to within $1\frac{1}{2}$ to $2\frac{1}{2}$ inches of the umbilicus, being rather higher in women than in men (Ewald, 'Diseases of the Stomach,' p. 115).

The only fixed part of the stomach is the cardiac orifice, which lies at a point on the posterior abdominal wall corresponding in front with the junction of the seventh left costal cartilage with the sternum.

When the stomach is distended, its position is somewhat altered. The greater curvature comes forward, and the anterior surface is thus caused to look upward as well as to the front, while the posterior wall faces downwards and backwards. The pylorus, which is freely movable, is under these circumstances usually displaced 2 or 3 inches to the right of the middle line.

In its greatest length the normal stomach measures rather over 10 inches, and its diameter at its widest part (toward the cardiac end) is between 4 and 5 inches. The normal capacity of the stomach varies greatly in different individuals, but is probably never more than $2\frac{1}{2}$ pints (Ewald, 'Diseases of the Stomach,' p. 120).

The wall of the stomach, which is thinner than that of the œsophagus, though thicker than that of the small intestine, is composed of four layers—the serous, muscular, submucous, and mucous.

The serous coat is composed of peritoneum, which closely invests the whole viscus, except at the greater and lesser curvature, where the attachment is looser, allowing space for the larger bloodvessels.

The muscular coat consists of unstriped muscular fibres arranged in three more or less distinct layers—longitudinal, circular, and oblique. Of these three, that which is of special interest is the middle layer. This, toward the pylorus, becomes thicker and stronger, and when it reaches the exit from the stomach the circular fibres are heaped up so as to project inward into the lumen of the passage and form a distinct sphincter. Under normal circumstances the calibre of the pyloric orifice has a diameter of rather less than half an inch. This diminution in the calibre is caused entirely by the increase of the muscular fibres, the

longitudinal fibres taking no part in the process, but passing on into the first part of the duodenum.

The submucous coat is composed of areolar tissue, and is the tunic in which the larger arterioles break up. The submucous tissue does not bind the mucous membrane very closely to the muscular layer, but permits considerable sliding one upon the other.

The mucous membrane, which is thickest in the pyloric region and thinnest in the great sac, is richly supplied with glands. The whole interior of the stomach is covered by a single layer of columnar epithelial cells. Scattered throughout the mucous membrane, but most abundant toward the pylorus, are small masses of lymphoid tissue, which are of importance as occasionally ulcerating in Hodgkin's disease.

The stomach receives its blood-supply from all three of the branches of the cœliac axis. The coronary artery of the stomach reaches the viscus at the cardiac end, and, after giving off branches to the lower part of the œsophagus, it runs along the lesser curvature from left to right, and anastomoses with the pyloric branch of the hepatic artery. From the hepatic artery two branches in part aid the supply of the stomach. The smaller of these, the pyloric branch, reaches the stomach at the upper margin of the pylorus, and passes toward the left along the lesser curvature to inosculate with the terminal branches of the coronary artery. The gastro-duodenal artery passes behind the first part of the duodenum close to the pylorus, and, after giving off the superior pancreatico-duodenal branch, continues from right to left along the greater curvature of the stomach as the right gastro-epiploic artery. The splenic artery runs along the upper margin of the pancreas from right to left, and supplies several small branches to the stomach before it gives rise to the left gastro-epiploic artery, which lies between the layers of the gastro-splenic omentum, and is continued along the great curvature of the stomach to anastomose with the terminal branches of the right gastro-epiploic artery.

From the two arches thus formed at the upper and lower margins of the stomach, vessels pass at right angles to supply

the body of the viscus. The ultimate branches of these form an intricate network in the interglandular tissue, and from the capillaries round the mouths of the glands the veins take origin. These in the mucous membrane are fewer but larger than the arteries. They form a plexus in the submucous tissue, and then pass along with the arteries to form larger veins corresponding to the large arteries already described—viz., coronary, left gastro-epiploic, right gastro-epiploic, and pyloric veins. These all empty into the portal vein, either directly, as in the case of the pyloric and coronary veins, or by joining the superior mesenteric or splenic veins.

The lymphatics of the stomach, which are very numerous, arise in intimate relation with the gland tubules. They form a plexus of dilated lymph sinuses in the submucous tissue, and then pass toward the upper and lower margins, where they traverse a number of lymphatic glands which lie along the gastric borders of the small and great omenta respectively. Thence they pass to the cœliac glands, which lie beside the aorta above the origin of the superior mesenteric artery, those of the lesser curvature following the course of the coronary vessels until the cardiac orifice is reached, when they turn down behind the pancreas to reach the cœliac glands. Those on the greater curvature run with the right gastro-epiploic vessels, and in part with the splenic vessels, and reach the same lymphatic glands. Thence they pass, together with the vessels which drain the mesenteric glands, to open into the lower end of the thoracic duct.

The nerves of the stomach, derived from the terminal branches of both pneumogastrics and from sympathetic branches from the solar plexus, are very abundant, and not only account for the very severe pain caused by ulceration, but also for the severe collapse produced by injury, though it is a mistake to suppose that manipulation of the pylorus is always attended by the severe shock suggested by the experiments made by Dr. Crile; for in many cases we have freely handled the stomach and pylorus, and operated on them without our patient experiencing more shock than would be expected after any abdominal operation. When the pylorus is adherent and the parts have to be much

dragged on, severe shock is not infrequently seen, but this is due to interference with the large sympathetic nerves and ganglia behind the pylorus.

The relation of the sympathetic nerves with the seventh, eighth and ninth spinal roots accounts for the superficial tenderness of the epigastrium in ulceration, and for the reflected left shoulder-blade pain. This is well shown in pyloric adhesions complicating cholelithiasis, where, though the pain is originally on the right, passing to the right infra-scapular region, as soon as the pylorus becomes involved in the inflammation or tied down by adhesions, the pain passes also to the left subscapular region.

The anterior surface of the stomach is in relation above with the under surface of the left lobe of the liver and the diaphragm, and below with the abdominal parietes opposite the epigastric region. The posterior surface rests upon the transverse meso-colon, behind which are the pancreas and great vessels.

Above, the stomach is connected to the liver by the gastro-hepatic omentum, in the free (right) border of which run the common bile-duct, the portal vein, and the hepatic artery. To the left of the cardiac orifice, between the œsophagus and diaphragm, is a small fold of peritoneum, the gastro-phrenic omentum.

The gastro-splenic omentum lies at the extreme left of the stomach, but is of more importance in the surgery of the spleen than of the stomach.

The great omentum is attached to the whole lower surface of the stomach, from which it passes down over the transverse portion of the colon.

The above description applies to the normal stomach, but there is probably no organ in the body which varies so much in size, position, and relations under pathological circumstances.

It may be so contracted, as in some cases of cancerous or simple stricture of the œsophagus, as to lie quite away from the surface and be tucked under the liver and ribs, forming little more than a thick-walled tube; on the other hand, in some cases of stenosis of the pylorus, it may be so dilated as

to occupy every region of the abdomen, reaching even behind the pubes into the true pelvis.

The pylorus, instead of readily permitting passage of the forefinger, may be so contracted as barely to admit a No. 6 catheter, and cicatricial contraction in the body of the stomach may so reduce its calibre at a particular point as to render it less than that of the normal pylorus.

The free border of the lesser omentum may be so shortened as to anchor the pylorus higher up than normal, and as a consequence of ulceration the pylorus or other part of the stomach may be fixed to the parietes or to neighbouring organs in such a way as seriously to interfere with the gastric functions; or the lesser omentum may be so wide as to allow the stomach to descend well below the umbilicus, as in Glénard's disease, and under such circumstances the pancreas can be easily felt, and when the abdomen is opened even seen above the lesser curvature of the stomach.

At a meeting of the Royal Academy of Medicine in Ireland, February 2, 1900, Professor Birmingham gave a demonstration of the form, position, and relations of the stomach as seen in bodies which have been hardened by intravascular injections of formalin. The chief points upon which he dwelt were: That the empty stomach is contracted, not collapsed, its pyloric portion resembling thick-walled small intestine; its cardiac portion rounded, but attenuated; its surfaces looking, the one up, the other down, and its long axis nearly horizontal. In this condition it rests on the 'stomach bed,' occupying only the lower part of the 'stomach chamber,' the upper part of this space being occupied by the great omentum and the transverse colon, which double up over the empty stomach and lie between it and the diaphragm. The large, flattened, and collapsed stomach, with anterior and posterior walls in contact, usually described and pictured, is not found in the hardened body. Three stages are recognised in passing from the empty to the distended condition. In the first the fundus and cardiac portions are expanded, the pyloric portion remains contracted, and the lesser curve sharply bent, as in the empty state; in this stage the stomach resembles a Florence flask,

strongly bent at the junction of neck and body. In the second stage the cardiac portion is further expanded, and the pyloric portion opens out, but the junction between the two is distinctly marked. In the third stage there is an enlargement of all the axes of the organ; the distinction between pyloric and cardiac parts is almost lost; the pylorus is carried an inch or two to the right of the middle line, and the antrum pylori is developed. But in all these changes there is no rotation around the long axis of the organ, with a raising up of the great curvature, etc., as commonly described. The distended stomach lies obliquely, its long axis running from the fundus, not vertically, as we have been taught in recent times, but inwards and downwards at an angle of about 40 to 45 degrees with both the horizontal and mesial planes.

Diagnosis.

Although diseases of the stomach naturally come under the notice of the physician at first, the time has passed when the surgeon can feel content to accept and act on the diagnosis already made for him by his medical colleague, leaving with the latter the responsibility of a possible error; rather, he must himself go over the whole of the medical evidence, and be prepared to supplement it by surgical methods, should such be required to elucidate the case or to render possible an accurate diagnosis.

The diagnosis of any case of gastric trouble necessitates both a general and a special inquiry. The former, which involves the questions of age, sex, occupation, habits, mental, moral, and physical condition, and the history both of the patient and the disease, can be best discussed when considering the special disease; the latter includes a consideration of all the information which the surgeon can elicit by a physical examination.

Inspection.—Inspection will always constitute our first effort in diagnosis, and it is important that the patient should be in the dorsal decubitus, lying comfortably in a warm and light room with the abdomen exposed to view. Dilatation of the stomach can often be ascertained by inspection, and it may in extreme cases be seen to occupy

every region of the abdomen. If the dilatation is atonic, the swelling persists without visible peristalsis; but if it is due to narrowing of the pylorus, visible peristalsis from left to right can frequently be plainly seen. Tumours of the pylorus and of the body of the stomach are frequently visible through the abdominal wall, and in an early stage they may be seen to move downwards on inspiration; this more especially applies to cases of cancer, since in tumours depending on ulcer of the pylorus adhesions form early, and fix the stomach under cover of the liver. Inspection will reveal the shallow, rapid, costal breathing induced by pain at the commencement of peritonitis, and by distension in the later stages, just as it will demonstrate the sighing respiration in internal hæmorrhage, and the irregular, catching breathing in diaphragmatic peritonitis or subphrenic abscess. It will show the fixed and bulging ribs in subphrenic abscess, and the swelling in the upper abdominal region when the pus tends to make its way forwards.

Palpation.—Palpation immediately follows inspection, and, of all methods which are adopted for diagnosis, it is the one which we can least afford to omit. With the patient supine in bed or on a couch, the head slightly elevated on a cushion, and the knees drawn up, the muscles of the abdomen are relaxed as much as possible. They can then easily be kept relaxed by talking to the patient, so as to divert his attention. The flat warm hand placed on the abdomen at once perceives any irregularity or abnormality. If the upper abdomen is rigid, it will raise the suspicion of local peritonitis, especially if, in addition, there is tenderness on pressure. Should there be a tumour, its nodular character, if malignant, will easily be felt; and if it be cancer of the pylorus in an early stage, it will in all probability be freely movable. If there be malignant disease of the body of the organ, the tumour will move downward on inspiration, but usually not freely from side to side, though we have seen a growth of the centre of the stomach forming an hour-glass contraction as freely movable as a pyloric tumour sometimes is.

It will be found better, as a rule, to slide the hand over the abdomen, and not to raise it from the surface, thus avoiding

fresh defensive contraction of the muscles, which will occur if the hand be raised and replaced on the abdomen. It may sometimes be advisable to employ gentle massage in order to elicit the presence of a tumour of the body of the stomach, or a swelling of the pylorus due to muscular spasm, as in pyloric stenosis. In some cases of ulcer a distinct tumour may be present at one time, owing to the contraction of the muscular coat, and absent at another, the tumour only being distinctly felt when the spasm is present. In diagnosing between atonic dilatation of the stomach and that due to obstructed pylorus, the vermicular contractions felt under the palpating hand are of the first importance. Where, as occasionally happens, palpation is difficult on account of rigidity of the muscles or of obesity, an examination under an anæsthetic may be advisable. Bimanual examination, with one hand in the loin and the other on the surface of the abdomen, will frequently give increased information as to the size of the tumour.

A tender and rigid epigastrium suggests ulcer of the stomach, and the situation of the tenderness is frequently a good guide to the site of the ulcer; for instance, if the tenderness be under the left costal margin and the left rectus be rigid, especially if the patient be relieved by assuming the dorsal decubitus, in all probability the ulcer will be on the anterior surface, whereas if the tenderness is on the right of the middle line, between the umbilicus and the right costal margin, the probability is that the pylorus is the affected part. When there are symptoms of ulceration without marked epigastric tenderness and with increase of pain on dorsal decubitus, and relief is found by lying on the face, the probability is that the ulcer is on the posterior wall of the stomach.

Palpation will usually bring out the character of the tumour as to hardness and softness, smoothness or irregularity. A nodular character of the tumour, especially if associated with fluid in the peritoneal cavity, usually indicates malignant disease.

Pulsation in an epigastric tumour is often felt, but if the growth is due to cancer it will be non-expansile.

Fixation of a tumour is suggestive of antecedent perigastritis, especially if tenderness be present; but it may also be dependent on infiltration due to malignant disease. While palpating the abdomen, it is important to distinguish between surface tenderness, which may be reflected, and deep pain, directly due to the disease which is being sought for. A change of posture may then be useful; for instance, with the patient on his left side a pyloric tumour will frequently change its position considerably—especially is this so in the early stages of pyloric cancer. Or, by making the patient assume the knee-elbow position, it may be more easy to distinguish and locate a small tumour at the pylorus or on the anterior surface of the stomach, as in this position the mass may be more readily felt by the hand placed flat on the upper abdomen than with the patient lying on his back.

A modification of palpation is succussion, which is of considerable use in determining the presence of a splash in a dilated stomach. It may be safely asserted that if the stomach splash can be obtained habitually three hours after a meal the stomach is abnormally dilated. No succussion splash should ever be obtained two hours after a test breakfast or five hours after a full meal, otherwise there is motor insufficiency, which may be confirmed by washing out the stomach and finding remnants of the meal.

The motility of the stomach is seriously affected by organic disease, but not by neuroses.

Palpation of the stomach may be made more distinct by distending the cavity of the stomach with gas. In this way one can diagnose hour-glass contraction, as well as ordinary dilatation, and can estimate the size of the cavity or cavities.

In subphrenic abscess on the right side, palpation will show if the liver is depressed, and this will form a link in the chain of evidence going to show that the abscess is between the liver and diaphragm, and not in the liver itself.

Percussion.—Deviation from the normal size of the stomach can usually be ascertained by percussion, first with the patient recumbent, and afterwards by mapping out the region of dulness when the patient is erect after he has drunk freely of water. After distending the stomach with gas, either through

a tube introduced through the mouth or by giving a dose of carbonate of soda in solution, followed by one of tartaric acid, percussion readily demonstrates the outlines of the stomach, and shows the position of any tumour both with regard to the orifices and to the greater or lesser curvature; and it also enables the diagnosis to be made between a pancreatic and a gastric tumour.

Percussion is also of use in demonstrating the presence of free fluid in the peritoneal cavity due to the rupture of a gastric ulcer, and for showing the absence of liver dulness under the like circumstance when sufficient free gas is present in the peritoneal cavity.

It must not, however, be forgotten that dulness in the flanks may be dependent on distension of the colon with fluid, and the similarity to free fluid in the peritoneum may be accentuated by change of posture, increasing the dulness in the dependent area and creating resonance in the elevated area. Again, resonance in the flanks may be created by distension of the colon with gas, and excessive distension of the colon may lead to error in diagnosis by pushing the liver well under cover of the diaphragm, thus leading to the belief that the liver dulness is abolished by free gas in the peritoneal cavity. We have known this to occur in a case of ruptured extra-uterine gestation which was thought to be one of rupture of a gastric ulcer.

Where a tumour is manifest to inspection or rendered evident by palpation, percussion is useful in eliciting the presence of a hollow viscus in front of it, as in diagnosing between a pancreatic and a gastric tumour; for in the former case light percussion will give resonance in front of the tumour, whereas in the latter light percussion will reveal dulness.

Auscultation.—Auscultation is of much more importance in the diagnosis of chest than of abdominal conditions, but it is sometimes useful in demonstrating the splashing sounds in gastric dilatation, and the gurgling or metallic sounds in subphrenic abscess containing gas. In the diagnosis of stricture of the œsophagus, where gastrostomy is in question, the gurgling sound on fluid reaching the stomach is usually

delayed several seconds in the presence of a constriction. Before performing gastrostomy it is of the first importance to be certain of the diagnosis. Dr. Ogston has pointed out that in a healthy person food occupies about four seconds in passing from the mouth to the stomach, and that if the ear be placed 3 inches below the angle of the left scapula an amphoric rushing sound is heard when fluid enters the stomach. But when there is a stricture of the gullet, it will usually be found that fourteen or sixteen seconds elapse before fluid reaches the stomach. This is a valuable addition to the ordinary well-known means of diagnosis.

In this connection it may be pointed out that spasm of the pharynx or of the œsophagus at times closely resembles organic stricture; hence, it may sometimes be necessary to make an examination with the patient anæsthetized. In estimating the size of the stomach by percussion, greater precision may be obtained by the observer applying the mouth of a stethoscope over the stomach while an assistant performs the percussion, when the altered note is readily recognised on the borders of the stomach being pressed.

Pain.—Though pain may be absent in some few examples, it is present at some stage of the disease in the greater number of stomach ailments calling for surgical treatment, and its character and course frequently afford the most valuable means at the disposal of the surgeon for interpreting and diagnosing ailments which present few physical signs.

The history of the onset of pain may show the local origin of more general trouble. For instance, in the diffused pain of general peritonitis due to the rupture of a gastric ulcer it is of the utmost importance to know whether it was preceded by pain after food and by epigastric tenderness, so that an exploration of the abdomen may be made over the site of the disease, and thus a great saving of time effected in the operation. In one case of ruptured gastric ulcer that Mayo Robson operated on, there were absolutely no previous symptoms of stomach disorder, and, thinking from the profound collapse, the sudden onset, the presence of fluid in the abdominal cavity, and the history of a missed period followed a fortnight later by irregular uterine bleeding,

that the case was one of ruptured extra-uterine gestation, the first incision was made above the pubes.

As a rule, however, the pain from perforated gastric ulcer, though ultimately diffused, will have been first felt in the epigastrium, and the history will disclose the past existence of pain after the ingestion of food, and probably indigestion of long standing; there will also frequently be a history of reflected pain in the left scapular region, though in some cases of pyloric ulceration with adhesions to the gall-bladder and liver we have found the pain reflected to the right scapular region.

Obscure recurrent abdominal pains may be dependent on a stricture or kink at the pylorus produced by adhesions, which, though not sufficient to cause obstruction, may produce considerable distress and disability. In this class of cases the local and reflected pain frequently affords much help.

Instrumental Aids to Diagnosis.—In subphrenic abscess the exploring syringe affords useful aid in diagnosing the presence of pus and enabling the surgeon to decide on the exact site of the incision for its evacuation.

Œsophageal bougies are employed in cases of dysphagia, not only for treatment, but to ascertain the site of the obstruction and its nature, when the question of gastrostomy arises. We prefer instruments made after the pattern of bougies *à boule* employed in urethral cases; they are not generally known, but they present great advantage, both in the ease and safety with which they can be utilized, and the facility with which they can be employed to dilate a stricture. Messrs. Rauschke, of Leeds, made the first set some years ago, and they have since copied them for other surgeons.

In a case of starvation from stricture of the œsophagus, the question of gastrostomy has to be considered; but it must first be shown that the disease is incapable of being overcome by other means. Simple stricture, which is a rare condition, may frequently be efficiently treated by dilatation. Cancerous stricture, on the other hand, cannot be safely dilated, and will require other treatment. If there be a history of steady loss of flesh and gradually increasing dysphagia in a middle-aged or elderly patient, malignant stricture will be suspected;

and if on passing a bougie it be arrested just before entering the stomach, the diagnosis is rendered very probable ; while if there be slight bleeding caused by the gentle use of the bougie, little doubt can be left.

Spasm is most frequent in the pharynx, though it may occur in any part of the gullet. It usually occurs in subjects younger than those who are affected by malignant stricture, and nearly always in women. It is, however, frequently associated with other nervous symptoms, it varies in intensity, and it usually yields to the passage of bougies without difficulty. If, however, a bougie cannot be passed in any case where spasm is suspected, an anæsthetic will at once settle the doubt, as under its influence a full-sized bougie usually reaches the stomach when the stricture depends on spasm alone. It is noteworthy that in cases of spasm the larger sizes of bougies are more likely to pass than the smaller, while in organic stricture the exact opposite holds good.

Electric illumination may sometimes be useful. It is accomplished by an apparatus consisting of a small electric lamp, fixed to the end of a bougie, which is passed into the stomach. If the stomach is full of water, an illuminated area is seen, which corresponds exactly to the limits of the organ. It is best demonstrated in the erect posture and in a dark room. In this way abnormal dilatation of the stomach can be detected, and a tumour appears as a dark spot in the light field.

With regard to the Röntgen rays, we have found both the screen and the skiagram of use in demonstrating the position of impacted coins, metallic anastomosis buttons, and other foreign bodies. The Röntgen rays have also been suggested for localizing the position and size of the pyloric orifice, after letting the patient swallow balls of different sizes made of bismuth nitrate or carbonate coated with keratin, which will be only temporarily arrested at the pylorus if it be patent, and the keratin covering of which will be dissolved on reaching the intestine, keratin not being soluble in the gastric juice. The *gastro-endoscope* has, however, not yet proved to be of any material service in diagnosis.

Vomited Matters and the Contents of the Stomach.—With regard to vomit, the first thing to consider is the quantity vomited at one time. Nurses should be trained to estimate this carefully, and also to preserve specimens on all occasions. In dilated stomach vomiting usually does not occur more than once daily, sometimes only on every second or third day, and the quantity at any time is correspondingly large.

In ulcer of the stomach a considerable portion of the last meal may be brought up within an hour or two of its ingestion, and the pain it has caused be thereby relieved.

The smell should also be considered, a yeasty smell being characteristic of dilatation of the stomach; a habitually fœtid odour, of cancer of the stomach; and a feculent odour, of intestinal obstruction.

Vomit is usually acid in reaction; but it may be alkaline in some cases of chronic dyspepsia, or when there is much blood present.

The most important abnormal constituent of vomit is blood. In large quantities its nature is obvious, and the event is suggestive of simple ulcer; but in cirrhosis of the liver profuse hæmatemesis may occur owing to rupture of dilated veins. In smaller quantities the vomit has a characteristic dark appearance, resembling coffee-grounds, and this may be due to cancer or simple ulcer. When the existence of blood in vomited matter is doubtful, the most reliable guide is the hæmin test, which may be done in the following manner:

Evaporate a small quantity of the gastric contents to dryness, powder the residue and place some along with a crystal of common salt on a microscopic slide, add a drop of glacial acetic acid and boil over a spirit lamp, cover with a cover-glass and examine under a high power for the small dark-brown crystals of hæmin. As a rule, it is not necessary to add sodium chloride, since fresh blood contains sufficient of it; but, since excess of the salt does not interfere with the reaction, it is well to use a crystal or two.

In cancer of the stomach, blood is frequently present in the vomit—often in small, sometimes in considerable, only rarely in large quantity.

Pus is sometimes, but not often, vomited. In considering both pus and blood in a fluid said to have been vomited, it must be remembered that when large quantities of fluid are expelled from the lungs—*e.g.*, on the rupture of an empyema into the lung or a profuse hæmoptysis—the sensation to the patient is often as if vomiting had occurred. The presence of food and the general absence of frothiness will help to distinguish true vomit, while vomited blood is generally much darker than blood from the lungs. But the only reliable way to make the distinction is to inquire carefully into the facts of the occurrence. Pus in the vomit may arise from an empyema of the gall-bladder, or a pancreatic or other abscess bursting into the stomach or œsophagus.

Examination by the microscope of vomited material is usually of secondary importance, but it sometimes affords great assistance, as in the case of a subdiaphragmatic abscess bursting into the lung described on p. 171, where the presence of half-digested muscular fibres and the absence of elastic tissue distinctly proved the source of the pus to be from the stomach, and not from an abscess of the lung or an empyema, and in some cases of cancer where portions of growths or groups of cells are occasionally obtained by means of lavage. In dilatation of the stomach the *sarcina ventriculi* is frequently to be seen, together with yeast cells. In cancer, where macroscopically there is no evidence of blood, red blood corpuscles may often be found.

In reference to the diagnosis of malignant disease of the stomach, the relative abundance or absence of free hydrochloric acid has been pointed out as being of importance by Ewald. In order to determine its existence, the patient should take a 'test breakfast,' consisting of a cup of weak tea and a little dry toast. An hour later the stomach-tube should be passed, and the contents of the stomach drawn off. These are to be tested by Gunsberg's test for free hydrochloric acid. The reagent consists of 2 parts phloroglucin and 1 part of vanillin in 30 parts by weight of absolute alcohol. When a few drops of the filtered contents of the stomach are evaporated to dryness in a porcelain dish with an equal quantity of the reagent, if free hydrochloric acid be

present red crystals will form ; should there be much peptone present no crystals, but a red paste, will result. The absence or deficiency of free hydrochloric acid occurs in several morbid states, but its presence is a strong point against a diagnosis of malignant disease of the stomach. Hyperacidity, on the other hand, is as characteristic of ulcer as diminished acidity is of cancer.

The mere presence of an acid reaction should not be held as proving the presence of free hydrochloric acid, since this may be caused by acid salts or by free organic acids. Of these latter the most important is lactic acid, and it the practitioner should be able to recognise, since its presence in appreciable quantity in the later stages of digestion is of considerable diagnostic import, implying as it does that excessive fermentation is going on in the stomach. It can be readily recognised by the use of Uffelmann's reagent, which can be made by adding 1 drop of liq. ferri perchlor. to 1 ounce of a 1 per cent. solution of carbolic acid. This will give an amethyst blue solution, the colour of which is changed to yellow on the addition of the merest trace of lactic acid. Since inorganic acids decolourize Uffelmann's reagent, while sugar, alcohol, and phosphates give the same reaction with it as lactic acid, it is necessary to extract the lactic acid by shaking the filtrate, left after filtering a small quantity of gastric contents, with ether, to allow the ether to separate from the watery solution, and after decanting it to evaporate the ethereal solution until only a few drops remain. If any free lactic acid be present, on adding some of this to Uffelmann's reagent the alteration in colour noted above will take place. The fatty acids, especially butyric acid, give a somewhat similar reaction, but only when present in larger proportions than they are found to occur in the stomach.

The motor activity of the stomach has been estimated in various ways, of which two may be mentioned :

1. Leube's method consists in washing out the stomach at various times after the administration of a fairly large meal—a quarter of a pound of freshly minced meat and some bread. Within six or seven hours the stomach should be empty ; but in cases of dilatation of the stomach, or other conditions

in which the functional value of the walls of the stomach is diminished, some food may be found many hours after.

2. Ewald's method depends on the fact that salol does not split up in the stomach, but that when subjected to the action of alkaline pancreatic juice it is decomposed, absorbed into the circulation, and, in part, excreted as salicyluric acid in the urine, where it can be readily detected by the addition of neutral ferric chloride solution, a violet coloration occurring. Ewald ('Diseases of the Stomach,' p. 55) advises that 15 grains of salol be given along with food, and the urine tested at intervals thereafter. Normally, he says, salicyluric acid will appear forty to sixty—at most within seventy-five—minutes after the administration of the drug; whereas in dilatation of the stomach its appearance will be delayed. A simple method of applying the test, devised by Ewald and Einhorn (Einhorn, 'Diseases of the Stomach,' p. 87), is to place a drop of urine on a filter-paper, and then let a drop of 10 per cent. ferric chloride solution fall on the moistened spot. The edge of the drop will in the presence of salicyluric acid assume a violet colour.

Various ingenious mechanical contrivances have been suggested for estimating the power of the stomach, but these appear to us scarcely to be suitable for practical use, even if the results to be obtained from any yet devised were certainly reliable.

Examination of the Blood for Leucocytosis.—See p. 70.

Exploratory Incision.—In only a small percentage of cases is simple exploratory incision, as a means of diagnosis, necessary, or even justifiable, and there can be no doubt but that in some cases it has served as a cloak for carelessness or incompetence. A careful physical examination, and time and care in studying the history of the case, will usually enable either an exact diagnosis or an approximate one to be made; and in the odd case the experienced surgeon can usually say it is one likely to be relieved only by surgical treatment, though possibly the exact pathological condition may be a matter of some doubt. Where there is doubt, and delay will not be injurious, a second or even a third examination should be made, as it is well known that at a second

visit new facts may be brought to light, the patient's memory may be stirred up, and small data, really important, but thought by the patient or friends to be too trivial to mention at the first visit, may form the key to the situation; moreover, the mind of the surgeon may on the next visit focus his attention on different points or group his data differently, and so perhaps arrive at a truer conclusion. In case of doubt a consultation is advisable, in order that the case may be considered from the point of view of the physician. It must not be forgotten, however, that the surgeon must bear the responsibility that awaits the decision, and he should be careful, if a positive diagnosis is decided on, to be able to answer two questions in the affirmative. First, Can I perform an exploratory operation without adding serious risk to the life of the patient, already threatened by the disease? Second, Is it possible that good will result from the operation? At times the surgeon may be called on to explore the abdomen for tumour of the stomach, which it is just possible may be amenable to surgical treatment, but where it is impossible to say beforehand whether the lymphatic glands are involved, or the disease has invaded the adjoining parts to such an extent that the removal of the growth would be useless. Under such circumstances, when the tumour is exposed, the great gift (usually a matter of common-sense combined with experience) of 'knowing when to stop' comes in; for although having made an exploratory incision may, and probably, with due precautions, will, have involved no risk to the patient, any interference with the tumour may inflict such injury on the growth that the surgeon is compelled to convert his harmless exploratory procedure into one of the most serious of operations, which, if it does not cause death on the table or shortly after, can lead to no ultimate good. This is sheer meddlesomeness, and for the credit of surgery, if from no higher motive, should be avoided.

Very frequently, however, when organic disease of the stomach is diagnosed, it is impossible to decide what operation is required until the stomach is exposed and handled. This applies very strongly to the early stages of cancer

of the stomach, for which operation in an early stage, before adhesions have formed and glands have become affected, holds out the only hope of cure, and also to cases of chronic ulcer and to disabling adhesions of the pylorus or stomach.

An exploratory operation is justified wherever cancer of the stomach is suspected, for the smaller the tumour, the greater will be the hope of a radical cure.

In some case of abdominal injury, either gunshot or stab wound, or even injury without external wound, the severe shock, the vomiting of blood, and the general condition of the patient, may lead to a suspicion that the stomach has been injured, and an exploratory incision may be justified, since, in case of the stomach having been ruptured, such an injury, if not repaired, would inevitably prove fatal. The following is a case in point :

A youth was admitted to the Leeds Infirmary suffering from shock, with vomiting of blood, following on a stab wound over the stomach. As there was free fluid in the peritoneal cavity, it was thought that bleeding was going on, and that possibly the stomach had been injured and its contents had become extravasated. An exploration showed a wound of the superior mesenteric vein, with bruising, but no wound of the stomach. The vein was ligatured and the abdomen cleared of blood, the patient making a good recovery.

At times all the symptoms of perforating ulcer may be present without a previous history of ulceration, and all that can be said is that a peritoneal catastrophe has occurred which threatens life. Under such circumstances an exploratory operation may be required. A case of this kind came under the care of Mayo Robson, where a lady was seized with violent abdominal pain at the railway-station. As she became profoundly collapsed, she was removed to the station hotel, and was seen by a medical man, who called a consultation. The only history obtainable was that there had been no stomach symptoms, but that the patient had missed her last menstrual period for nearly a fortnight. As there was free fluid in the peritoneal cavity, which was thought to be blood due to a ruptured extra-

uterine gestation, and as the liver dulness was present, the abdomen was opened above the pubes, when free non-odorous gas escaped, showing that the case was one of ruptured gastric ulcer. The incision was therefore closed, and another opening made over the stomach, in which a perforated ulcer was found. The perforation was closed and the abdomen cleansed by sponging, the patient making a good recovery.

Incision for Exposure of the Stomach.—Although incision in the middle line between the xiphoid and the umbilicus gives the readiest access to the stomach, in some cases, especially if there is doubt as to what may have to be done, it is not always the best site, for three reasons :

1. It is apt to be followed by yielding of the scar and hernia, unless long rest is enjoined after the operation.
2. The round ligament of the liver, with its irregular adipose envelope, is apt to be in the way and to prove confusing.
3. To prolong the incision for further investigation is inconvenient, because of the umbilicus.

These difficulties, of which the first only is of importance, are obviated by an incision through the inner margin of the rectus muscle just to the right or left of the middle line. An incision on either side gives ample room ; but if the pylorus has to be attacked or gastro-enterostomy to be done, it is better on the right ; if gastrostomy has to be performed, it is better on the left. Afterwards, if the abdominal wall is sutured layer by layer, there is no fear of hernia or of a weak scar being left ; moreover, there is no difficulty in extending the incision if more room is required. For routine work we find the incision in the middle line sufficiently satisfactory, as it can be very quickly performed, and with careful suturing we have not found it give rise to subsequent hernia. The oblique incision along the costal margin is undesirable, because it divides muscle so freely, and exact repair by suture is difficult ; hence permanent weakness of the abdominal wall and ventral hernia are more likely to occur. As a matter of fact, with due care in applying sutures, any one of these methods may be employed, and the operator should

select that which will give him the best access to the parts to be manipulated.

Gastrotomy.

Gastrotomy is the term applied to the operation of opening the cavity of the stomach. It is one of the oldest operations on the stomach, having been practised by Matthis of Brandenburg so long ago as 1602 for the removal of a knife that had been accidentally swallowed. But as a diagnostic method with a view to further treatment gastrotomy is a modern procedure. Exploratory gastrotomy has only been performed within the last few years; but by its means an extensive and minute examination of the interior of the stomach may be made with thoroughness and safety, so that in any case calling for operation, where by other means a positive diagnosis cannot be arrived at, the surgeon is justified in opening and exploring the stomach. It will be convenient in this place to consider the operation of gastrotomy as a whole, bearing in mind that one of its purposes may be simply exploratory.

It may be performed—

1. For the removal of foreign bodies from the stomach.
2. For the removal of foreign bodies from the lower end of the œsophagus.
3. For dilating a stricture of the œsophagus.
4. For dilating a stricture of the pylorus.
5. For the removal of a polypus or other tumour projecting into the stomach.
6. For exploration in case of intractable or bleeding ulcer.
7. For curetting a cancer of the pylorus, as in Bernay's operation.

The preliminary incision of the parietes, which has already been described, requires to be rather free for gastrotomy. After the abdomen has been opened, flat sponges or gauze pads should be packed round the stomach, so as to avoid soiling of the peritoneal cavity. The edges of the wound having been retracted, the stomach can now be palpated; and if palpation from the front does not give the information required, a tear may be made in the gastro-colic omentum,

so as to admit the fingers to palpate the posterior surface. The stomach should now be drawn forward, surrounded by a sheet of sterilized gauze, and opened by a free incision in its longitudinal axis. Divided vessels must be seized and ligatured, and the liquid contents of the stomach mopped or siphoned out, if they have not been pushed on into the duodenum before the stomach was opened. On retracting the edges of the gastric incision, the interior of the stomach will be brought into view, and may be further explored by the electric cystoscope, if thought necessary, as, for instance, in hæmatemesis from a small bleeding ulcer. If the posterior wall be the part affected, it may be invaginated by the fingers, inserted through the omental slit, pushing it forward into the wound. A tumour may now be removed, an ulcer excised, a bleeding-point ligatured or cauterized, the pylorus exposed and divulsed, the œsophageal opening exposed and dilated, or other treatment may be carried out.

In the case of foreign bodies in the stomach, there is, of course, no need to make the omental wound; but an anterior incision may at once be made, and the object or objects seized and removed. The incision in the stomach can be rapidly closed by a continuous catgut suture for the mucous membrane and a continuous silk suture for the serous edges, a few Lembert's sutures of silk sometimes being applied over all for greater security. The exposed parts may then be gently sponged, the pads or sponges removed, and the abdominal wound closed without drainage. Beyond teaspoonfuls of water for the first twenty-four to forty-eight hours, all feeding is best done by enemata; but after forty-eight hours the amount of liquid foods may be increased. Later, pultaceous food may be given, but it is better not to give solid food for a week, after which the treatment should be as in any other abdominal case.

Dr. Keen (*Philadelphia Medical Journal*, May 7, 1898) insists on the necessity in this, as in all similar operations on the stomach, of washing out the organ before it is opened, of bringing it out of the peritoneal cavity, and of protecting the peritoneum by a wall of iodoform gauze. Lavage of the stomach is, however, undesirable before gastrotomy for

foreign bodies and for hæmorrhage, and is unnecessary as a routine preliminary to operation; but it is desirable, if practicable, to have the stomach emptied before proceeding to open its cavity.

Gastrotomy for Foreign Bodies.—The removal by gastrotomy of foreign bodies lodged in the stomach has been attended with considerable success. A preliminary disten-



FIG. 1.—FOREIGN BODIES SUCCESSFULLY REMOVED FROM THE STOMACH OF A GIRL, AGED TWELVE. (MAYO ROBSON.)

For detailed report, see *Lancet*, November, 1894.

sion of the stomach with fluid or air is neither advantageous nor desirable. The indications for operation are the presence of a foreign body which can neither be safely dissolved nor allowed to pass through the gut, and which is actually producing, or is likely to produce, serious symptoms. One of us (Mayo Robson) has described a case (*Lancet*, November 3, 1894, p. 1028) in which 'forty-two cast-iron garden nails $1\frac{5}{8}$ inches long, ninety-three brass and tin tacks from $\frac{1}{2}$ inch to 1 inch long, twelve large nails (some brass-headed),

three collar-studs, one safety-pin, and one sewing needle,' were removed by gastrotomy, the patient, a girl, twelve years of age, making a complete recovery and being now in good health. The photograph here reproduced from the College of Surgeons' Museum shows the objects removed. The value of transfusion of saline fluid in the treatment of shock was well shown in this case. Although practically no blood was lost and the operation was not very prolonged, the patient, who had been much exhausted from excessive vomiting before the operation, was pulseless after its termination, yet transfusion restored the pulse and rendered recovery possible.

Dr. A. G. Bernays described a case in which, through an incision 5 inches long in the linea alba, he successfully removed a table knife from the stomach of a man who had swallowed it within an hour previously. The patient was fed by the rectum only for four days, but after that time food was given by the mouth.

Professor Loreta mentions the case of a woman who, having swallowed needles with suicidal intent, suffered severe pain. On gastrotomy being performed, several needles were removed from the stomach and others were drawn out of the left lobe of the liver. The patient recovered without a bad symptom, and was entirely freed from her suffering.

Among the foreign bodies removed by gastrotomy are masses of hair forming a dense ball. The most remarkable specimen of this kind was successfully removed by Mr. Paul Swain. It weighed 5 pounds 3 ounces. It can be seen in

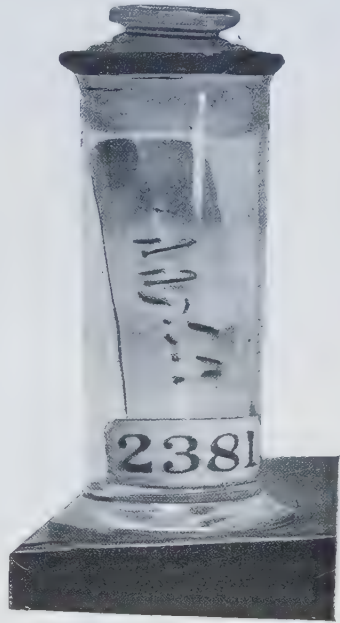


FIG. 2.—BENT PINS REMOVED FROM SPECIMEN 2379 (FIG. 5).

the Museum of the Royal College of Surgeons of England. A photograph here reproduced of the mass of hair is taken from the specimen in the museum. Schoff (*Wiener Medicinische Wochenschrift*, November 16, 1899) has collected sixteen cases of hair-ball in the human stomach, of which eight were removed by operation, all successfully. Statistics show the mortality in gastrotomy for foreign bodies to be

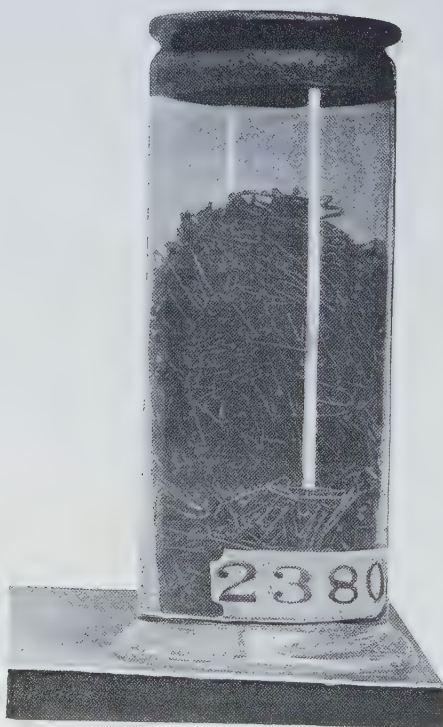


FIG. 3.--PINS REMOVED FROM SPECIMEN 2379 (FIG. 5).

15 per cent. in a series of seventy-nine cases; but the later cases show a smaller rate, and with the improved technique of to-day it will doubtless diminish considerably. Crede (*Archiv. für Klinische Chirurgie*, 1886), and Ericker (*Deutsche Med. Wochenschrift*, 1897) have collected fifty-four cases, with ten deaths; Heydenreich (*La Semaine Médicale*, 1891) has collected thirteen cases, with two deaths; Schoff (*Wien.*

Med. Wochenschrift, November, 1899) has collected eight cases, with no death; and Mayo Robson (*Lancet*, December 23, 1899) collected four cases without a death.

The following case, though not actually a gastrotomy, is of interest from a historical point of view, and it seems to be convenient to place the account here while discussing the operation for removal of foreign bodies from the stomach. The account is taken from the *British Medical Journal*, 1901.

'It may be remembered by those among us whose professional memory can carry them back a quarter of a century, that in the

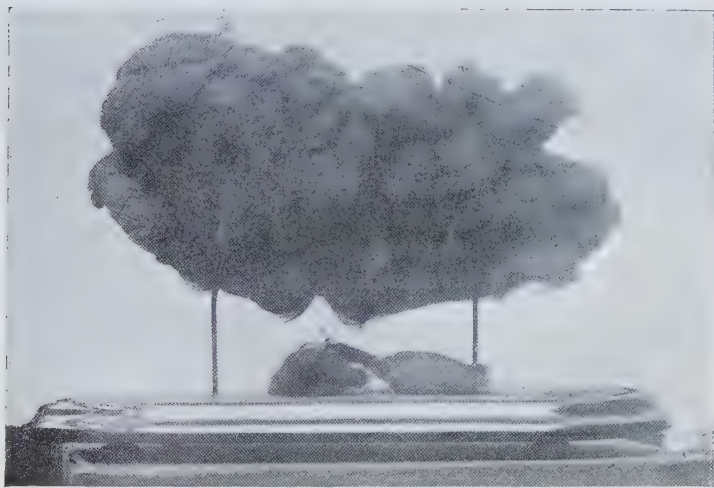


FIG. 4.—A ROLL OF BLACK HUMAN HAIR, 12 INCHES LONG, WEIGHING 5 LBS. 3 OZ., REMOVED SUCCESSFULLY FROM A GIRL OF TWENTY.

Lancet, 1895, vol. i., p. 1581. (No. 2,381, Royal College of Surgeons' Museum.)

mid seventies there was much talk in the newspapers of a Frenchman who had swallowed a fork. The fork was successfully removed by M. Labbé, surgeon to the Charité, now a member of the French Senate, and the case is quoted in the books as marking a step in the development of the surgery of the stomach. The man, whose name was Lausueur, lately died, twenty-five years after the operation. He was an assistant in the Magasins du Printemps, a large drapery establishment, and he was in the habit of amusing his fellow-employés by putting into his mouth down to the handle the big scissors—30 centimetres long—with which he cut samples. One day at luncheon in the early part of

1875, by way of what our ancestors would have called a "merrie and conceited jest," he introduced a fork into his mouth with the handle downwards, holding the points between his teeth, and closing his lips so as to hide the fork. On opening his mouth to take it out again he drew in his breath, and the fork slipped down



FIG. 5.—PHOTOGRAPH OF STOMACH FROM A MARRIED WOMAN, AGED FORTY-ONE, WHO HAD SUFFERED FROM HÆMATEMESIS AT SEVENTEEN AND SEVERAL TIMES LATER.

Ultimately, three weeks' incessant vomiting led to death. A post-mortem examination showed the pylorus behind the pubes, the duodenum being distended by a mass of pins weighing nearly a pound and causing obstruction. There were no peritoneal adhesions. (No. 2,379 Royal College of Surgeons' Museum.)

into the gullet. Attempts to seize it with forceps failed, and it finally found its way into the stomach. The affair for some weeks figured prominently in the newspapers. "L'homme à la fourchette" was the sensation of the day, and he must have been a good advertisement for the Magasins du Printemps, for people

wrote there from Russia, from America, and nearly every part of the world, asking for particulars of the accident and as to the condition of the patient. Lausseau, who was a man of cheerful disposition, did not allow himself to be depressed by the knowledge of the formidable foreign body which he had in his stomach. He actually composed a waltz about it, which he called "La Fourchette," and he used to sing it, accompanying himself on the piano. He did not, as a matter of fact, suffer so much inconvenience as might have been expected, and it was only when the fork got into an awkward position in the stomach that acute pain was caused. After a time, however, an abscess formed, which pointed under the umbilicus, and symptoms of constitutional disturbance showed themselves. M. Labbé opened the abscess and removed the fork, which he found projecting into the abscess cavity, the stomach being adherent to the abdominal wall. This was the first instance in which a foreign body was removed from the stomach by a surgical procedure, though it was not, strictly speaking, a gastrotomy.'

The following case, recorded in the *British Medical Journal*, November 17, 1900, p. 1423, by Mr. Walter Spencer, is worth relating here :

'A married woman, aged forty-eight, was transferred to me by Dr. Murrell with the following history: She had been in very good health until ten months ago, when suddenly one day, whilst walking in the street, she was seized with a violent pain in the epigastrium, which made her feel as though she was going to burst. The abdomen swelled up, but she did not pass flatus; for seven weeks she was in bed on a fluid diet, with poultices on the abdomen. Then she got up and tried to take ordinary food, but it caused a choking sensation, with an aching pain in the epigastrium. On several occasions the attacks of pain seized her as at the first, with swelling of the abdomen, constipation, and scantiness of urine. A fixed lump appeared in the epigastrium, and the pain became worse whilst moving about, and caused her to suffer from dyspnœa.

'In the medical ward the patient could only take fluids, and did not improve. It was decided, therefore, to explore the painful lump in the epigastrium, and the case is an admirable instance of the value of surgical exploration in obscure and stationary cases. The pyloric third of the stomach was found adherent to the back of the abdominal wall, being pinned there by a fishbone $2\frac{1}{2}$ inches in length and of the size of a stout needle. One end was fixed in the left rectus muscle, and the other end of the fishbone projected

into the pyloric third of the cavity of the stomach, the middle of the bone being surrounded by a small thick-walled abscess cavity. The fishbone, after being swallowed, having arrived at the pylorus, instead of passing through end on, had become wedged athwart the orifice, and subsequently, by the peristaltic movements of the stomach, one end had been driven through the stomach into the abdominal wall. This accounts for the sudden attack, the immediate result of which was a reflex inhibition of intestinal peristalsis, causing the abdomen to become swollen by tympanites, and inducing constipation and scanty flow of urine. At the same time there was partial obstruction to the escape of food from the stomach, hence the subsequent difficulties in digestion. The patient could never recall having swallowed the bone. The fishbone was extracted, and the adhesions of the stomach to the abdominal wall divided. The portion of the anterior wall of the stomach, which had formed a thickened mass about $1\frac{1}{2}$ inches in diameter around the bone, was excised; then the gap was closed by a double row of sero-muscular sutures. The abdominal wound healed at once, a sinus leading down to the abscess cavity closed after a short delay, and she was seen some time after her discharge from the hospital in good health.'

The effect produced on the stomach by various foreign bodies accidentally or intentionally swallowed can be studied in a series of specimens in the Hunterian Museum at the Royal College of Surgeons. Photographs of several of the specimens are here reproduced.

No. 2,377 (Royal College of Surgeons) shows the remains of a knife swallowed two months before death. No. 2,378 (Royal College of Surgeons) shows the blades and iron portions of three or more clasp-knives swallowed by a man and voided *per anum*; the man recovered. No. 2,379 (Royal College of Surgeons) shows the stomach from a woman, aged forty-one years, who had suffered from hæmatemesis at seventeen years of age and several times later; ultimately incessant vomiting led to death. A post-mortem examination showed the pylorus behind the pubes, and the duodenum distended by a mass of pins weighing nearly a pound, which had caused the obstruction. The bent pins removed from the last specimen are shown in No. 2,380 (Royal College of Surgeons). No. 2,381a (Royal College of Surgeons) shows a roll of black human hair, 12 inches long and weighing

5 pounds 3 ounces, removed from a girl, twenty years of age, by Mr. Paul Swain; the patient recovered.

Gastrotomy may be performed for the removal of foreign bodies impacted in the lower end of the œsophagus when all attempts to remove them by the mouth or to push them on by bougies have failed.

When a foreign body, except in the case of a coin, is impacted in the lower part of the œsophagus, and cannot be removed by ordinary means, the surgeon may pursue one of three courses:

(a) *Œsophagotomy in the neck*, which is not to be recommended.

(b) *Intra-mediastinal œsophagotomy*, an extremely difficult and dangerous operation, which has, we believe, never been done successfully.

(c) *Gastrotomy*, the operation we would recommend as being safer and more efficient than any other.

In the case of impacted coins, our experience is that by the use of the instrument known as a coin-catcher, which we believe was invented by the late William Hey, of Leeds, they can always be safely removed.

One of us (Mayo Robson) recently published two cases of this kind in children where, after the coins had been localized by skiagraphy, they were removed by means of the coin-catcher with the greatest facility, although they had been impacted for four months (*British Medical Journal*, vol. i., 1898).

At the American International Medical Congress Dr. Maurice H. Richardson (*Boston Medical Journal*, December 16, 1886) read a paper on the possibility of operation on the œsophagus through the stomach. He had verified his statements by experiments on sixty bodies, and had in one case operated successfully on a man, thirty-seven years of age, who had eleven months previously swallowed a denture of four teeth, which had become impacted at the lower end of the œsophagus. The patient had lost fifty pounds in weight, and it was found to be quite impossible to extricate the plate by means of forceps introduced through the mouth. After the stomach had been opened, the hand was inserted;

on reaching the cardiac orifice, the finger discovered the plate about 2 inches above the diaphragm. By means of digital manipulation it was detached and withdrawn; the stomach was then carefully sutured, and the abdomen closed. The patient rapidly gained weight, and was soon able to resume his work. The conclusions Dr. Richardson drew from his experiments were: that the oblique incision below the margin of the ribs is the best; that the stomach, after being withdrawn from the abdomen a little, should be opened to the right of the convexity of the lesser curve; that the assistant should, by traction on the stomach, put the lesser curve on the stretch; and that the sulcus so formed is always a certain guide to the cardiac orifice. When a foreign body is impacted at the lowest part of the œsophagus, it is about 6 inches below the opening made in œsophagotomy; and if it be firmly impacted and require much force to detach it, the safer plan will probably be to perform gastrotomy, and draw it down a little way, than to perform œsophagotomy, and draw it forcibly a distance of 6 inches past very important structures.

Dr. Bull, of New York, has recorded (*New York Medical Journal*, October 29, 1897) an operation in which he successfully detached an impacted peach-stone from the lower end of the œsophagus in a thin boy, aged sixteen years, and then, by attaching a piece of string to a sponge, and dragging the sponge upwards from the gastrotomy opening to the mouth, he was able to bring the stone with it.

In the *Lancet* for February 23, 1901, is an account of a case by Mr. Flavell Edmunds, where gastrotomy was successfully employed in a man, aged forty-five, for a tooth-plate impacted in the lower end of the œsophagus.

Gastrotomy as a preliminary to forcible dilatation of the pyloric or cardiac orifice of the stomach was suggested by Richter, and carried out by Loreta in September, 1882.

In stenosis of the pylorus, however, divulsion has, speaking generally, given way to pyloroplasty or gastro-enterostomy, for the double reason that pylorodiosis has a greater death-rate, and is more liable to be followed by relapses. It may nevertheless be advisable in those cases due to spasm and

hypertrophy of the pyloric sphincter. In a certain number of these cases, however, the sphincter may be divulsed without gastrotomy by invaginating the stomach wall, and gradually pushing the finger through the pyloric opening, as suggested by Hahn. This subject will be considered more in detail under simple dilatation of the stomach.

In simple cicatricial stricture of the œsophagus at or near the cardiac orifice, if dilatation by bougies is impossible or has failed to keep the stricture open, the operation of gastrotomy may be performed, and an attempt made to dilate the orifice from below. This operation has proved very successful. Gissler (*Beiträge für Klin. Chirurgie*, Tübingen, 1892, vol. viii., p. 109) has collected ten cases, and Kendal Franks twenty-one cases, all the patients recovering. The operation may be performed in two stages, in which case a large gastrotomy opening must be made and the dilatation proceeded with later. The one-stage operation is to be preferred, as the finger can then palpate the cardiac orifice, and a mechanical dilator may be used if necessary. For subsequent operation a gastric fistula may be left, if it be thought that there will be difficulty in keeping the passage patent by bougies introduced through the mouth. The dilator that Loreta employed was after the pattern of Dupuytren's lithotomy dilator, only longer, and incapable of dilating beyond 5 centimetres. Kendal Franks used Otis's urethrotome, from which he had previously removed the knife. Weiss's rectal dilator may be conveniently employed. Abbé has recently devised a method of dividing a simple stricture of the lower end of the œsophagus, or of the cardiac orifice of the stomach, by passing a string through the stricture from below until it emerges at the mouth; then, by putting the string on the stretch, and running it rapidly upwards and downwards, the stricture is soon divided. The stomach and the abdominal opening are then closed, and the stricture is kept permeable by the regular passage of bougies. The diagnosis is of the first importance, as in malignant disease the operation will be useless and may be very dangerous. In simple stricture of the cardiac orifice there will probably be a history of corrosive fluid having been swallowed some time previously,

and the symptoms will also be of longer duration than if the stricture be malignant.

Gastrotomy for the removal of a polypus or other growth projecting into the cavity of the stomach or occluding the pylorus is an operation seldom required, since simple tumours of the stomach are uncommon. The following is a good example: A middle-aged man, with a history of long-continued dyspepsia and of loss of flesh, came under the care of one of us—Mayo Robson—for dilatation of the stomach, which was producing the usual symptoms with great loss of flesh. The pylorus appeared to be thickened, and on opening the stomach the lumen of the pylorus was seen to be occupied by a polypoid projection with a wide base, so that the passage of the stomach contents onward was almost completely prevented. The removal of the growth by scissors, and the suture of the longitudinal wound transversely, led to such relief that the patient gained weight at first at the rate of half a pound a day, and in three months he weighed between two and three stones more than before the operation. The growth proved to be an adenoma.

Chaput (*Bulletin et Mémoire de la Société de Chirurgie*, 1894) records a case in which he excised a pedunculated adenoma from the posterior wall of the stomach; and C. B. Lyman (*Annals of Surgery*) reports a case of removal of a pedunculated carcinoma of the stomach through a gastrotomy opening. Mr. Bennett (*British Medical Journal*, February 3, 1900) has reported an interesting case of the kind, where the removal of a simple papilloma that occluded the pylorus from time to time, and led to intermittent dilatation of the stomach, cured the patient, a man aged thirty-five years, who had been ill for years.

Gastrotomy for exploration in cases of intractable gastric ulcer not yielding to ordinary treatment, and for gastrorrhagia, will be considered more conveniently when we come to discuss ulcer of the stomach.

Gastrotomy for partial removal of cancerous growths in the stomach by the curette is an operation that has been performed by Dr. Bernays, of St. Louis. He has recorded (*Annals of Surgery*, December, 1887) some cases in which

he had given relief by this method ; but in view of the better results from gastrectomy or gastro-enterostomy, it is scarcely likely that this operation will continue to hold a place in surgery, both from its uncertainty and from the danger of hæmorrhage and perforation ; moreover, the relief given by such an operation can only be of a very temporary nature.

CHAPTER II

CONGENITAL STENOSIS OF THE PYLORUS

CONSIDERABLE attention has within the last few years been given to this condition, which has been variously described as 'congenital stricture,' 'congenital hypertrophy' of the pylorus, and 'congenital gastric spasm.'

The first recorded case is that given by Williamson (*London and Edinburgh Monthly Journal of Medical Science*, 1841, p. 23); the second that by Davoski (*Caspar's Wochenschr.*, 1842, No. 7). These two cases, however, sank out of remembrance, and were only recalled after the description of a case in 1888 by Hirschsprung of Copenhagen (*Jahrb. f. Kinderheil.*, vol. xxviii.). Since then over forty examples have been met with.

Symptoms.

The symptoms may appear immediately after birth, or more frequently after an interval of a few days or weeks. The chief of them is vomiting, coming on without apparent reason immediately, or very shortly, after the administration of food, accompanied by restlessness or convulsions, and increasing gradually in frequency until it becomes persistent. Though this is the rule, it is not invariable; for, as the stomach slowly distends, the vomiting may become less frequent and in larger quantity. Temporary relief has been noticed after washing out the stomach through a Nélaton catheter, and the regular administration of very small quantities of fluid. It has been especially emphasized in many cases that the vomit contains no bile. More or less swiftly—in proportion, probably, to the degree of stenosis—

the stomach expands, and eventually may occupy the greater part of the abdomen. The child wastes rapidly, and the intestines, through lack of food, become collapsed and empty. The contrast, then, between the upper half of the abdomen, containing the distended stomach, and the lower half, in which lie only shrunken coils of intestine, is striking and remarkable. Constipation is, of course, present, as the bowel has no contents of which to relieve itself. When empty, the stomach may be felt as a hard, rounded swelling in the epigastrium.

A pyloric tumour has been palpable in a few cases. When the stomach is distended with food or air, waves of contraction may be seen passing across it. Emaciation is progressive and extreme, and the little infant, constantly vomiting, dies of starvation and exhaustion. Such is the clinical picture of an acute case.

There are, however, on record certain cases which have been diagnosed as congenital stenosis, but which have recovered. Still suggests that these are instances of developmental variations in the amount of muscular tissue in the pylorus in which the stenosis is not great. It is more than probable that slighter degrees of the same disease, not proving fatal in infancy, may come under observation later, as examples of pyloric stenosis; for, as Rolleston says, 'it is conceivable that a primary muscular excess might in course of time undergo a fibrous transformation, and result in fibrous stricture of the pylorus.'

The following interesting case, reported by Dr. Coates (*Lancet*, December 8, 1900, p. 1645), is worth giving *in extenso*. Recovery seemed to be due to systematic washing out and cleansing of the stomach. Probably stenosis of the pylorus, spasmodic or structural, was the cause of the dilatation.

A girl was born on January 24, 1900, and weighed 7 pounds 13 ounces. She seemed quite healthy, and apparently remained so for nearly three weeks. Her mother was unable to nurse her. She was fed on humanized milk. On February 14 she began to be frequently sick. From the 17th to the 19th the vomiting suddenly changed in character; she was sick only once in twenty-

four hours; then a very large quantity, at least a pint, came away. At the same time micturition became scanty, and the motions consisted of only small quantities of mucus stained almost black with altered bile. The stomach was manifestly much dilated, whilst, from the absence of residue of food in the bowels and the very scanty micturition, it was evident that little or nothing passed through the pylorus; but whether there was stenosis, or whether the enormous dilatation of the stomach had produced a kink that nothing could pass, was not evident. The treatment consisted in feeding her at intervals of two to three hours with small, measured quantities of food. One teaspoonful of the following mixture was given after each meal, to aid the digestion and prevent fermentation in the dilated stomach: *Acidi hydrochlori dil.*, 25 minims; *glycerini pepsini acidi*, $1\frac{1}{2}$ drachms; *acid-carbolici*, $\frac{1}{2}$ grain; *aq. ad* $1\frac{1}{2}$ ounces. On the 28th, as she was slowly but steadily losing ground, nutritive enemata were given. Each enema consisted of 1 ounce of peptonized human milk with 2 drops of brandy. The enemata were given every three hours until the end of May, and, with the exception of a few days when there was some diarrhœa, they were always retained and absorbed. The bowel was washed out once a day with soap and water. Early in March she had severe gastro-intestinal catarrh, with sickness and diarrhœa. The vomit contained greenish-yellow muco-pus mixed with curds. The stools were frequent and foul-smelling. She had fever, the temperature varying from 90° in the morning to 102° at night, and a loud endocardial mitral regurgitant murmur was developed. She lost flesh very rapidly, her weight on March 17 being 5 pounds 13 ounces, a loss of 2 pounds since birth. Her condition looked perfectly hopeless. She was extremely emaciated, and had a shrivelled, dry skin and distended abdomen. The abdominal wall was so thin that the liver could be recognised from the dark colour showing through. The dilated stomach could also be easily made out, and slowly-moving peristaltic waves were seen passing over it from time to time. For a few days milk was entirely stopped by the mouth, and she was put on raw meat, meat juice, and warm water as food, and sulpho-carbolate of soda and carbonate of bismuth as medicine. A few days later, as her temperature never rose above 99° and the diarrhœa had stopped, human milk was given as well. On March 19 she had still lost weight, being now 5 pounds 11 ounces at seven weeks from birth, when she ought to have weighed over 10 pounds.

From the constant loss of weight and general condition, it was obvious that she would die unless the state of her stomach could be improved, and as a last resource it was determined to wash it

out with a solution of sodium bicarbonate, 25 grains; sodium sulpho-carbolate, 15 grains; euthymol, $\frac{1}{2}$ drachm; aq. ad $1\frac{1}{2}$ ounces. On March 22 a No. 12 soft elastic catheter, india-rubber tube, and glass funnel were used. The catheter was passed through the mouth every morning about three hours after a meal. When the catheter entered the stomach, gas generally escaped, and then from 3 to 4 ounces of thick slime and curdled milk were evacuated. The stomach was then washed out, and the resultant fluids were measured. Immediately after the stomach was cleansed, a teaspoonful of the following mixture was given: Spiritus ætheris chlorici, 15 minims; bismuth carbonate, 40 grains; sodium bicarbonate, 12 grains; sodium sulpho-carbolate, $\frac{1}{2}$ drachm; decoctum hæmatoxyli, 6 drachms; aq. cinnamon ad $1\frac{1}{2}$ ounces; and a quarter of an hour later she was fed with 2 or 3 ounces of human milk freshly drawn off. She was fed alternately every two or three hours with from 2 to 3 ounces of human milk and 1 ounce of meat-juice. She was not put to the breast, so that there should be no opportunity of overfilling the stomach. From this time improvement was decided; she spent very comfortable days, but used to get rather restless by evening, and was decidedly uncomfortable during the night. The day after the washing out was commenced she began to pass much more urine; three days later and subsequently she had almost normal motions. At the end of March the meat-juice was stopped, and she was put regularly to the breast. By April 2 she had gained 2 ounces; by the 6th she had gained 2 ounces more. As the nights were bad and the days good, lavage was performed night and morning about three hours after a meal. Each time about 3 ounces of slime and curd were removed. By May 1 she had gained over 1 pound, her weight being 6 pounds 13 ounces. She made uninterrupted progress, so that by the 12th the residue of slime and curd removed was reduced to between $1\frac{1}{2}$ and 2 ounces. After the 19th lavage was performed only occasionally. On the 23rd, after forty-eight hours' interval, only $1\frac{1}{2}$ ounces of residue was found. On the 30th her weight was 8 pounds 4 ounces; on July 17 over 12 pounds. Her heart was now perfectly normal, the murmur having disappeared on March 20.

There are two points worth noting: (1) The patient's sensations of hunger were apparently caused by the absence of digestible food in the stomach. She always showed signs of hunger two or three hours after feeding, even though her stomach contained 3 or 4 ounces of slime and curd. After this had been removed, the stomach cleansed, and 2 or 3 ounces of milk given, she would appear to be satisfied for over two hours, although the stomach

really contained less than when she was hungry. Her sensations of repletion depended on the nutritive value rather than on the quantity of the matter in the stomach. (2) Her attack of severe febrile, muco-purulent, gastro-intestinal catarrh was rapidly followed by the appearance of a loud mitral systolic murmur which resembled one due to rheumatic endocarditis. Soon after the stomach was brought into a healthier condition and the catarrh and fever had subsided, the murmur disappeared.

Cases of febrile disturbance, accompanied by gastro-intestinal trouble, and followed by excited action of the heart and the development of an endocardial murmur, usually at the mitral orifice, are common in children. This case appears to show that the endocardial infection came from the alimentary canal. An extremely severe attack of acute dilatation of the stomach was thus cured by systematic lavage twice a day. After a few days it was clear that the food given was better digested, and that less slime was secreted.

A degree of congenital stenosis is doubtless a frequent, though often an unrecognised, cause of dilatation of the stomach in young adults. Maier (*Virch. Archiv.*, Bd. 102) cites a number of cases, mostly in adults, of chronic catarrh of the gastric mucous membrane, with dilatation, in which stenosis of the pylorus, varying from 3 millimetres to 1 centimetre (the normal being 1 to 3 centimetres), was found. He is careful to distinguish between the congenital form and that due to catarrh, ulcer, and cancer, the acquired forms of stenosis, and gives his reasons for considering the stenosis primary and the catarrh secondary in the cases mentioned. He acknowledges, however, that clinically the distinction is extremely difficult. Basing his classification on the anatomical structure of the pylorus, he distinguishes between a simple form of stenosis, in which there is a round or slit-like narrowing of the pyloric orifice, and a complicated form, due to a hypertrophy of the longitudinal or of the circular fibres of the pyloric region. In the first case, where the longitudinal fibres are hypertrophied, the stenosis is usually conical in shape, with the apex of the cone at the pylorus, and projecting into the duodenum after the manner of the os uteri into the vagina; but sometimes it is ringlike, the constriction then measuring as low as from 4 millimetres to 5 millimetres. When the circular fibres, on the other

hand, are increased, the form taken is usually that of a thick swelling, the lumen of the canal not being so much reduced as in the former case.

This form of stenosis may explain many of the cases of dilatation and catarrh of the stomach coming on in young adults without apparent cause, and it may also explain many of the cases of persistent vomiting set down to a vicious habit, or to hysteria. To judge from the literature of the subject, this condition is not of frequent occurrence; but it may be more common than is supposed, as necropsies are not frequently made in the case of children dying out of hospital, and persistent vomiting in infants is not a very uncommon event.

The transition from the acute cases, speedily ending in death, occurring in infants, and the chronic cases, where symptoms are noticed for the first time in young adults, or where symptoms long troublesome in a slight degree become aggressive, is clearly shown by the following series of cases:

1. **BATTEN'S CASE.**—A male infant eleven weeks old, weighing $7\frac{1}{4}$ pounds. Up to the age of five weeks the child was quite well; he then began to throw up his food, and had continued to vomit afterwards. A diagnosis of pyloric hypertrophy was made from the following points: (1) A healthy baby at birth. (2) Vomiting. (3) Constipation. (4) Subnormal temperature in rectum. (5) Wasting. (6) Marked dilatation and peristalsis of stomach. (7) A tumour in the position of the pylorus. (8) Absence of the usual signs of gastritis. The infant was fed by a nasal tube. Treatment was begun in December, 1898. In May, 1899, the patient weighed 16 pounds. In August an attack of acute gastro-enteritis with broncho-pneumonia proved fatal. At the post-mortem a hypertrophied pylorus and stomach were found.

2. **KEHR'S CASE.**—During the first few months of life the child had developed normally; then it began to vomit every time it took food, and to lose weight. Stenosis of the pylorus with hypertrophy was found at the time a gastro-enterostomy was performed.

3. **SONNENBURG'S CASE.**—In which gastro-enterostomy was performed in a child of five years of age for congenital stenosis.

4. **HUNSY'S CASE.**—A boy aged eleven, who had suffered from infancy from general alimentary disorder, whose principal symptoms were swelling of the abdomen, especially in the left

lower region, vomiting of large quantities of half-digested food, false appetite, constipation, etc. The signs were splashing or gurgling in the swollen region, cyanosis, and undoubted emaciation. On distending the stomach with carbonic acid gas, it was found to be enormously enlarged, extending downwards to the symphysis pubis. On opening the abdomen a 'concentric thickened ring of hypertrophy round the pylorus' was found, about a finger's breadth in width, without any cicatrix or other adhesions that would raise any suspicions of preceding inflammation. Gastro-enterostomy was performed with good results. Hunsy adds that the case is 'doubtless one of congenital muscular hypertrophy of the pylorus.'

5. MAYO ROBSON'S CASE.—Mr. A. J. H., aged twenty-four; had suffered from indigestion which had been present for five years, and which had had a gradual and painless onset. He had discomfort and fulness after meals with flatulency, evidently associated with fermentation of the stomach contents. He was 5 feet 10 inches in height, but only weighed 8 stones 10 pounds, and, as he had recently further lost weight and strength, his friends were naturally anxious about him. He had already had his stomach washed out twice a week for some time, but without benefit. On making a physical examination no tumour could be felt; but the stomach splash was easily obtained, and on distending the stomach with CO₂ it was found to reach three fingers' breadth below the umbilicus. On June 9 an operation was performed on him, when the pylorus was found to be contracted, so that the little finger could only with difficulty be passed through it.

Pylorodiosis was performed by Hahn's method, and the pyloric sphincter was stretched until it readily admitted two fingers by invagination. The operation was performed at Huddersfield with the assistance of Dr. Irving, under whose care he remained. He made a good recovery, and gained about $\frac{1}{2}$ stone in weight in the course of the next few weeks. The improvement lasted for three months, when he arrived at a standstill for a month, and during the next three months he rapidly lost what he had gained, and his weight diminished to 8 stones 7 pounds. There was no vomiting, and he had no pain, but the fulness and flatulency with acidity continued. We saw him again in January of the following year. On distending the stomach, we found that it had returned to its former volume. He was thin from illness and weak, and in spite of lavage of the stomach, careful feeding, and rest in bed he made no improvement, and it became clear that unless something could be done he would probably die.

A posterior gastro-enterostomy was therefore performed on

February 25, 1900. It was interesting to note that a distinct scar over the pylorus could now be seen, as if the pylorodiosis had led to ulceration, and so to cicatricial contraction. He is now making a satisfactory recovery from the gastro-enterostomy.

There can be little hesitation in affirming that a congenital abnormality in the pylorus of some, at present indeterminate, character may after the lapse of few or many years be so altered, or added to, as to cause symptoms of pyloric obstruction. The conditions and the frequency of such cases require further investigation.

Pathology.

In some cases the stomach is found enormously dilated; in others there is a moderate degree of dilatation, with hypertrophy. In all the pylorus shows a funnel-shaped circular thickening. This has varied in extent from $\frac{1}{2}$ an inch to 2 inches, and has tapered to an apex at or beyond the pylorus. The passage through the pylorus may be quite impermeable, or capable of admitting a probe. Looked at from the duodenal side, the pyloric mass bears a close resemblance, frequently remarked by authors, to the projection of the cervix uteri into the vagina. The mucous membrane is everywhere thrown into folds. The tumour may be due to fibrous thickening of the submucous coat, to hypertrophy of the circular or longitudinal muscular coats, or to any combination of these.

No satisfactory explanation of the ætiology of the disease has yet been put forward.

The following views have been held: 1. That the hypertrophy is the result of spasm from some irritant in the stomach. 2. That it is a developmental overgrowth. 3. That it is a result of the congenital narrowing of the lumen of the pylorus, followed by compensatory hypertrophy of the stomach. 4. That it is a functional disorder of the nerves of the stomach and pylorus, leading to an ill co-ordination, and therefore an antagonistic action of their muscular arrangement.

Treatment.

Rectal and nasal (to avoid the peristalsis set up by deglutition) feeding have been advocated for the slighter cases. The severer cases must be submitted to operation, as first suggested by Schwyzer.

The first successful operation was recorded by W. Abel (*München. Med. Wochen.*, November, 1899). The patient was a male infant, eight weeks old, and anterior gastro-enterostomy was performed. Nicoll recorded (*British Medical Journal*, September, 1900) the second successful case, Loreta's operation being performed. Kehr relates two recoveries after operation in children, nine weeks and six months old. Monnier (*Deut. Zeit. f. Chir.*, 1901) states that a successful case of gastro-enterostomy which he relates is the sixth.

Unsuccessful cases of gastro-enterostomy are recorded by Meltzer, Stern, Adler and Thomson. A fatal case of pylorotomy is also recorded by Thomson. The operation of choice in all such cases is clearly gastro-enterostomy. Pyloroplasty, on account of the great thickness of the pylorus and its rigidity in the whole circumference, is inapplicable. Pylorotomy is unnecessarily severe. Gastro-enterostomy is quicker and probably much safer. Murphy's button should on no account be used to effect the anastomosis.

Congenital Atresia of the Pylorus.

Hammer (quoted by Nicoll, *loc. sup. cit.*) distinguished between congenital **stenosis** characterized by great thickening, and congenital **atresia**, in which no thickening is found. He describes a case of congenital atresia in which the pyloric end of the stomach and the upper end of the duodenum formed culs-de-sac abutting on one another, and united by a fibrous band in which there was ultimately found an exceedingly fine channel, which, however, had proved impervious to fluid under pressure, used as a test.

The disease has in all recorded examples run a rapidly fatal course. If diagnosed early, it should, nevertheless, prove amenable to surgical treatment.

CHAPTER III

INJURY OF THE STOMACH

WOUNDS of the stomach may be incised, lacerated or gunshot. Incised (punctured) wounds are caused by stabs with sharp-pointed instruments of metal or wood. Lacerated wounds are the result of severe contusions, kicks, blows with the fist, falls, or buffer accidents. The stomach is less frequently injured than the intestine, owing to its protection by the chest-wall and liver. The stomach may also rupture spontaneously or by injury from within.

A wound of the stomach may involve the mucous coat alone, the mucous and muscular, the muscular and serous, the serous alone, or all the coats; it may or may not be associated with a wound of the abdominal wall, and may be found on either the anterior or the posterior surface. The symptoms will vary according to the nature and extent of the wound. If the mucous surface alone is wounded, gastrorrhagia of greater or less severity will be noticed. In some cases there has been copious vomiting of bright arterial blood, showing that a vessel of some size has been wounded. If the serous coat alone is torn, there will be a localized peritonitis, which may possibly lead to a perigastric abscess. If a complete solution of all the coats occurs, the symptoms and signs will depend in some degree upon the amount and character of the food present in the viscus. If the stomach be empty, the extravasated fluid will consist of gastric juice, with remnants of food and mucus, and it will be, comparatively speaking, innocuous. If the stomach be laden with recently-acquired food, the material escaping into the peritoneal cavity will be abundant in quantity, and

will contain various forms of micro-organisms. Septic peritonitis will result in either case, but the measure of its virulence will depend upon the quantity and character of the extravasation. The symptoms following immediately upon the receipt of the injury are pain, collapse and hæmatemesis.

Pain is of widely varying intensity, but is generally severe; the whole of the abdomen, but especially the umbilical and epigastric regions, are sensitive and tender. Any attempt at movement excites or increases the suffering. The pain may pass upwards to the sternal region, or laterally. Shortness of breath or difficulty of breathing are often mentioned as appearing early.

Collapse is sometimes immediate and profound, and is then due to hæmorrhage from a large vessel. The pulse is rapid, thin, compressible, the skin cold and pallid; there is a bursting forth of sweat over all the body. Gradually the abdomen, at first held rigid and tense, becomes swollen, and the signs of a general peritoneal infection swiftly assert themselves.

Hæmatemesis is the most important symptom. It may be noticed immediately after the accident, or only after the lapse of an hour or more. Clayton records a case of persistent hæmatemesis, after a crush, from which the patient died; a laceration of the mucous membrane of the stomach was found.

The following case occurred to one of us (A. W. M. R.):

HÆMATEMESIS FOLLOWING ON STAB WOUND OF ABDOMEN: ABDOMINAL SECTION.

On January 27, 1897, a young mechanic, aged twenty, was admitted to the Leeds General Infirmary after vomiting of bright blood following on a stab wound of the abdomen, the wound having been inflicted by a long, fine, triangular file that had caught in the lathe at which the youth had been turning.

On admission he was pale and collapsed, with a pulse of 190; and as there were signs of free fluid in the peritoneal cavity, it was thought that the stomach had been perforated, and that the bleeding was from a ruptured gastric artery.

On opening the abdomen a large quantity of blood and clot was found free in the abdominal cavity, and in the kidney pouches

and pelvis, but on carefully examining the stomach no perforation could be found. After some searching the superior mesenteric vein was found bleeding freely, the file having bruised and pushed aside the stomach, pierced the great omentum, and then wounded the vein.

The abdomen was washed out with hot water after the vein had been ligatured, and this also arrested the gastrorrhagia, as the patient made a good recovery and had no further hæmatemesis. The shock was relieved by the infusion of 3 pints of normal saline solution into the median basilic vein, and by injections of liq. strychniæ.

The bleeding was evidently from bruising, and possibly laceration of the mucous coat of the stomach, and not from a large vessel, as it was apparently arrested by the hot lavage, without any actual operation on the stomach itself.

If the wound, or the chief of several wounds, is on the posterior surface of the stomach, the symptoms and signs are equivocal, and a localized effusion in the lesser bag will result. The first case of this kind was recorded by E. Rose.

Rehn of Frankfort related, at the German Surgical Congress of 1896, the case of a girl, aged nineteen, who fell some distance heavily on to the abdomen. The symptoms suggested injury to the stomach. A laparotomy was performed five hours after the accident. A turbid fluid escaped through the incision. On the anterior wall of the stomach were two wounds, which involved the serous and muscular coats. A tear was seen in the great omentum close to the stomach, from which fluid issued. This opening was cautiously enlarged, and the posterior wall of the stomach exposed. A wound 4 inches in length was then laid bare, involving all the coats of the posterior wall of the stomach. This was stitched, a wound in the spleen sutured, and the abdomen closed.

After-Results.

As a general rule, a wound of the mucous membrane of the stomach heals readily. Cases, however, are recorded by Lebert, Brinton, Fenwick, and others, of acute ulceration of the stomach following immediately upon injury in previously healthy individuals; and Potain relates one example in which the ulcer became chronic.

Gunshot Wounds of the Stomach.

The experience in the South African War has shown beyond doubt that, with small-calibre bullets moving with high velocity, a gunshot wound of the stomach will in almost every instance recover without operative interference. The further history of men so wounded has yet to be written, and evidence is not lacking, in our experience, which goes to show that such history is not uneventful. Complaint of indefinite pains in the upper part of the abdomen, digestive disturbances, and so forth, have been met with in two cases in our experience, but the patients did not remain sufficiently long under observation to warrant any positive statement. But the lessons of the war do not apply in civil practice. The gunshot wounds of the abdomen we meet with are inflicted most commonly by rude and uncertain weapons—‘toy’ pistols or revolvers. Such wounds are ragged and contused, and do not heal spontaneously. The rule should therefore be in all cases to operate. Exploration is safer than uncertainty.

Injury of the Stomach from within.

There are on record a number of cases of spontaneous rupture of the stomach—of rupture, that is, independent of ulcer or carcinoma, or other visible disease. Such a bursting results from overdistension. Arton reports a case in a negro aged fifty years. Fulton mentions a case of rupture of the œsophageal end of the stomach in a child owing to distension. Collins describes a spontaneous rupture in a woman seventy-four years of age; this was followed by collapse and death, and a necropsy showed a rupture 2 inches long, about 2 inches from the pyloric extremity. The records of St. Bartholomew's Hospital contain the account of a man, thirty-four years of age, who for two years had been the subject of paroxysmal pain in the stomach. At the hospital he had an attack of vomiting after a debauch, and after a sudden attack of pain at the pit of the stomach he died. A ragged opening on the surface of the stomach near the cardiac extremity was found post-mortem, there being no signs of gastric ulcer or cancer. Clarke (*Indian Medical Gazette*,

1885) reports two cases—one in a Hindoo, twenty-two years of age, and another in a woman who was supposed to have died from cholera. Recovery probably never occurs naturally in these spontaneous ruptures.

Perforation may occur from within, as in the case of sword and knife swallows. A remarkable case of this kind occurred at Guy's Hospital in 1807. After death there were thirty or forty fragments of knives found in the stomach, one of which had transfixed the colon and the rectum. Needless to say that in all these cases the sooner after the injury the patient is treated the greater will be the chance of recovery.

Treatment.

In every case of wound of the stomach, however produced, in which all the coats are involved, operation should be resorted to at the earliest moment.

If any doubt be felt as to the existence of a perforating wound of the stomach, the œsophageal tube may be passed, and the stomach inflated with air. If the organ is intact it will distend, and its outline will be plainly visible; if burst, the gas will escape into the peritoneal cavity, and probably cause an immediate loss in the liver dulness.

The abdomen will be opened through a central incision, and the stomach at once exposed. Careful search, both on the anterior and posterior surfaces, must be made, and the entire organ examined. If the wound be small, the bubbling of fluid or gas through the aperture will at once indicate its locality; if large, there will, of course, be little or no difficulty in discovering it. The wound should be stitched up with a continuous suture of catgut, including the mucous membrane alone or all the coats, and a suture of silk picking up the serous coat only. If there has been, as in gunshot wound, a destruction of a portion of the wall of the stomach, an omental flap or graft may be usefully employed to close the resulting gap. Enderlen has recently shown (*Deut. Zeit. f. Chir.*, 1900) experimentally in the cat that, when a portion of the stomach wall is excised, there is a free prolapse of mucous membrane. To the cut edges of mucous membrane

he stitched a graft of omentum, and the gap in the serous coat was then closed by a large omental flap. The experiment proved, not only that the transplantation succeeded, but that the omental tissue gradually assumed the character of gastric mucous membrane, and well-formed glands developed.

Care must in all cases be taken to insure that a wound of the posterior surface is not overlooked. It would, we think, be a safe and wise precaution in all operations to turn the great omentum upwards, tear through the transverse mesocolon, and expose the posterior surface of the stomach, as in Von Hacker's operation. The existence of multiple wounds must be always contemplated as a possibility. In one reported case there were no less than three wounds in the stomach, two of which were sutured; the third, being undiscovered, led to death from peritonitis.

Dr. G. Woolsey reports a case of wound from a pistol bullet in which he had successfully sutured two wounds of the stomach, two of the transverse, and two of the ascending, colon.

‘Kopfstein has related the case of a schoolboy who shot himself in the stomach playing with a revolver. It was about one o'clock in the day, shortly after a meal, when the accident occurred, and he was straightway taken to hospital. The abdomen was not found to be tender; the pulse was accelerated, vomiting present, and the patient was very pale. The wound was observed in the parasternal line, and deviating towards the left, directly under the margin of the ribs.

‘One hour later it was resolved to perform laparotomy. The abdomen was freely opened in the median line, and the whole of the stomach to the left laid bare. On the upper, or convex, side of the liver a star-shaped mass of blood was found on the peritoneal covering, which was continued into the parenchyma of the organ as far as the sound would go without injury. A sharp-cut perforation was present in the stomach, admitting the free passage of a pencil, with no prolapse of mucous membrane, which is often assumed to close these wounds rapidly. Close to the wound in the gastric wall a large vessel was seen pulsating; none of the stomach contents were observed in the liver or the track of the bullet.

‘The hepatic hæmorrhage was checked by “Paquelin,” and the walls of the stomach were closed with Lembert’s sutures.

‘The stomach was then lifted up and its posterior aspect examined, but nothing abnormal could be found. The abdomen was then washed out, and the wound closed in three stages.

‘After the operation he vomited once. Temperature, 37.7° Cent., equals 99.86° Fahr.; pulse, 120. Next day he took fluids with comfort. The first dressing was removed twelve days after the operation, and the patient dismissed from hospital twenty days after admission.’—*Medical Press*, 1900.

CHAPTER IV

SIMPLE TUMOURS OF THE STOMACH.

THESE tumours are rare. Their clinical importance is small, and their symptoms, though frequently trifling and quite inconspicuous, may suggest a diagnosis of pyloric stenosis or cancer. The following forms are known :

1. Adenoma.
2. Lymphadenoma.
3. Lipoma. Lipo-myoma.
4. Myoma. Fibro-myoma.
5. Cysts.

1. **Adenoma** may be found at any portion of the stomach, though it is most commonly found near the pylorus. At

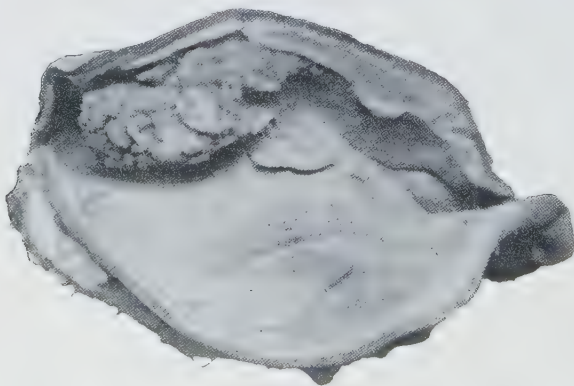


FIG. 6.—VILLOUS GROWTH NEAR LESSER CURVATURE, FOUND POST-MORTEM IN AN AGED WOMAN.

(No. 2,407a, Royal College of Surgeons' Museum.)

first a rounded, smooth projection is formed on the surface of the organ ; gradually, owing to a narrowing at the peri-

phery, the little tumour becomes pedunculated, and then hangs pendulous from a narrow stalk. One of us, in operating upon such a case, was able to see the cherry-shaped nodule carried on into the pylorus, which it blocked with the completeness of a ball-valve. When the tumour is of large size it may form a readily-palpable mass of extreme mobility, generally situated above the umbilicus, but occasionally descending below it. According to Sutton, these tumours are sometimes 'so mobile that they may be shifted into all the regions of the abdomen.'



FIG. 7.—POLYPUS NEAR PYLORUS, WHICH CAUSED DEATH BY VOMITING. The patient was a woman aged ninety-two. (No. 2,405d, Royal College of Surgeons' Museum.)

Adenoma of Stomach (under the care of Dr. Hinds, Worthing, who has kindly supplied us with the accompanying notes) :

'A. C., female, sixty-eight years of age. Complained of painful "gripings" in the stomach and frequent action of the bowels at irregular times; she had wasted and was unable to work. On examination of the abdomen a hard tumour was felt in the epigastrium, freely movable and capable of being pushed to the left of the spine as low as the umbilicus, and to the back under the right ribs, where it was lost.

'*Operation.*—Median incision; the tumour was found to be within the stomach. The anterior wall of the stomach was opened, and a tumour the size of a golf-ball found attached to

the posterior wall by a base about 1 inch in diameter, which involved the pyloric opening. The tumour was removed by cutting through the mucous membrane around the base, but at one point the posterior wall at the junction of the stomach and duodenum was opened; bleeding was slight. The posterior

wound was closed from within the stomach. The patient recovered from the operation, and was well for twelve months, putting on flesh, and returning to her work. Then sickness, flatulence, and a feeling as if the food "could not get past somewhere," with wasting and inability to work. Gastro-enterostomy by Von Hacker's method was performed eighteen months after the first operation, but the patient died of exhaustion in forty-eight hours. At the autopsy an ulcer $\frac{3}{4}$ inch in diameter, involving the pylorus, was found. There was no sign of growth.'

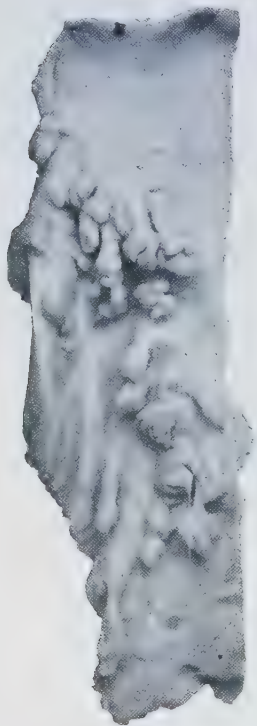


FIG. 8.—POLYPI GROWING FROM THE MUCOUS MEMBRANE OF THE STOMACH OF A GENTLEMAN, SEVENTY-SIX YEARS OF AGE, WHO SUFFERED FROM CONSTANT DYSPEPSIA.

(No. 2,405, Royal College of Surgeons' Museum.)

Hayem describes two cases of adenomatous growth, the structure of which resembled Brunner's glands, chiefly affecting the submucosa. The growth appears to be derived from the glandular cul-de-sac of the mucosa, but it rapidly passes through the muscularis mucosæ, and develops in the submucous tissue. In Hayem's cases the adenoma was associated, in the first with the perforation of an ulcer, and in the second with malignant disease. Hayem regards them as benign tumours which may become malignant.

A case of adenoma simulating cancer was shown in 1894 to the Société de Chirurgie at Paris by Chaput. The patient was a man aged sixty-four. The symptoms were chiefly emaciation, vomiting of coffee-ground material, and an epigastric tumour was observed. At the operation an adenoma

covered with normal mucous membrane was found attached by a small pedicle to the posterior wall of the stomach.

Adenomata are occasionally multiple. Adenoma and malignant disease may be present in the same stomach (Leeds Museum).

2. **Lymphadenoma.**—A rare form of tumour, characterized by exuberant polyposis of the mucous membrane. A very good example is described and figured by Pitt (*Trans. Path. Soc.*, 1889). Several masses of growth projected into the cavity of the stomach, one measuring 2 inches across and

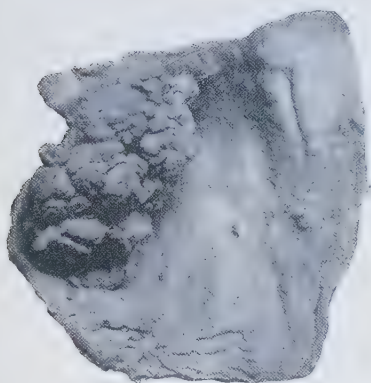


FIG. 9.—POLYPUS NEAR PYLORUS WHICH CAUSED FATAL INTUSSUSCEPTION OF DUODENUM IN A MAN AGED TWENTY-ONE.

(No. 2,405c, Royal College of Surgeons' Museum.)

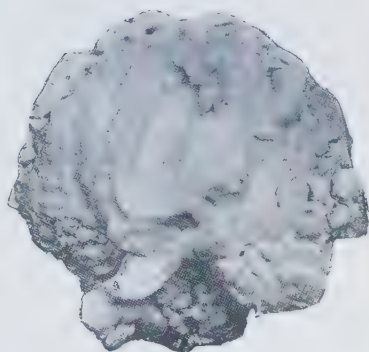


FIG. 10.—ADENOMA REMOVED FROM STOMACH.

(Dr. Hind's Case.)

1 inch thick. Norman (*Dublin Journal of Medical Science*, vol. xcv.) reports a case in which symptoms were absent. The mucous membrane was everywhere thickened, and presented all varieties of polyposis, from large dendriform projections to small wartlike growths.

3. **Lipoma.**—Lipomata are occasionally found in the sub-mucous layer of the stomach near the pylorus. Such a specimen is figured in Virchow's work ('*Die Krankhaft. Geschwülste*').

A case of **lipomyoma** is reported by Kunze (*Ann. of Univ. Med. Sci.*, 1891). The patient was a man aged fifty-two, who complained of a tumour in the epigastrium. The chief

points remarked were that the swelling was hard, nodular, and extremely mobile. There were no stomach symptoms. A diagnosis of mesenteric tumour was made and an abdominal section performed. The growth was found in the anterior wall of the stomach at the cardiac end. The patient succumbed in fifteen days.

4. **Myoma and Fibro-myoma.**—These forms are generally found as prominent, rounded, hard swellings in the coats of

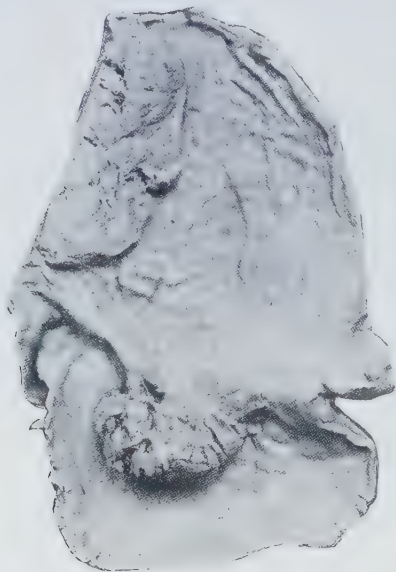


FIG. II.—MALIGNANT PLAQUE IN STOMACH WALL—POLYPOID GROWTH AT THE PYLORUS.

the stomach. They may in their enlargement become pedunculated and project either towards the mucous or the serous coat of the stomach, forming the varieties known as 'internal' and 'external.' Wilks and Moxon state that 'cases are recorded where a polypus of this kind has been vomited up.' These tumours grow slowly, are smooth or nodular upon the surface, and, if projecting into the stomach, are attended by hæmorrhage.

Myoma of the stomach was first observed in 1762 by Morgagni. Vogel in 1845, Förster in 1858, and Sangalli in 1860, recorded examples.

Herhold (*Deutsche Med. Wochens.*, 1898, No. 4) records an example of myoma in a woman thirty-seven years of age. There was a three years' history of intractable vomiting occurring soon after food. The stomach was moderately dilated and the vomit contained free HCl. As there was a

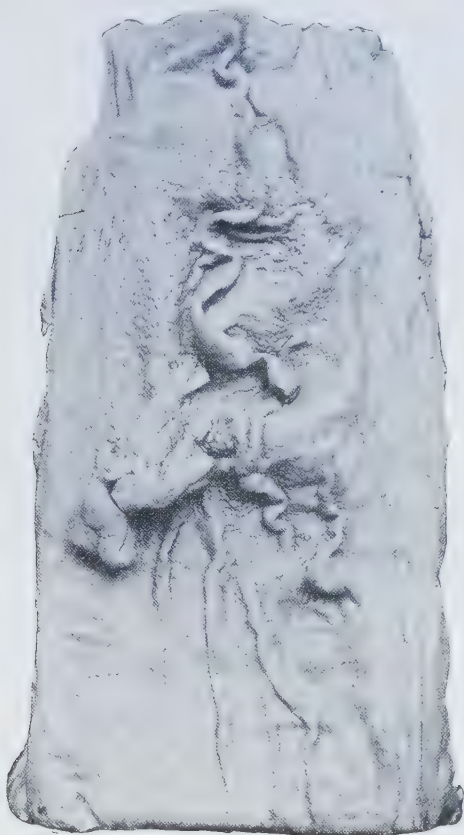


FIG. 12.—LYMPHADENOMA OF STOMACH.

history pointing to old peritonitis, it was supposed that there were adhesions pulling on the pylorus. On opening the abdomen, a tumour was found in the pyloric region of the stomach of the size of a hazel-nut, obstructing the duodenum to a moderate degree. The tumour, which was removed, proved to be a myoma.

The following cases are also recorded :

Ruprecht of Dresden (*Archiv. f. Klin. Chir.*, Bd. 40) removed a myoma, 10 centimetres by 7 centimetres, from the anterior wall of the stomach near the cardia. The patient died of pneumonia.

Von Erlach (*Wien. Klin. Woch.*, 1895, No. 15) removed an enormous myoma weighing $5\frac{1}{2}$ kilogrammes from the anterior wall of the stomach with success.

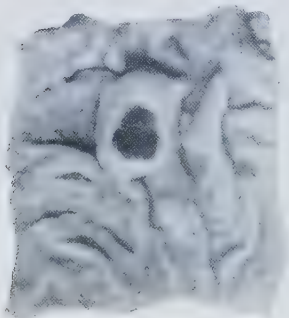


FIG. 13. — VILLOUS GROWTH
NEAR LESSER CURVATURE,
FOUND POST-MORTEM.

(No. 2,407a, Royal College of Surgeons' Museum.)

The successful removal of a very large *fibro-myoma* has been accomplished by Professor von Eiselsberg. The growth was 'the size of a man's head,' and hung downwards from the greater curvature. The portion of the stomach bearing it was also removed (*Archiv. f. Klin. Chir.*, Band 54).

Nicoladoni has also removed a myoma of the stomach (Steiner, *Beit. z. Klin. Chir.*, 22). The patient was *in extremis*, and died from purulent peritonitis. An area of the stomach wall, 26 centimetres by 14 centimetres, was removed from near the greater curvature.

Altogether, nineteen cases are recorded in surgical literature. Of these, eleven are external, six internal, and in two details are not given. Of the eleven external, seven grew from the greater curvature, one from the lesser, one on the anterior wall, and two from near the pylorus. The external growths are generally not recognised as arising from the stomach until an operation is performed for their removal.

Myosarcoma is described by Virchow and Brodowski.

5. **Cysts.**—Wilks and Moxon describe a case of cyst in the walls of the stomach of about the size of a walnut. Cysts of small size from dilatation of the glands are not very infrequent.

Ziegler has recorded a case occurring in the Munich Clinic in which, as the result of an injury, a tumour formed in the walls of the stomach. Laparotomy was performed, and a

cyst found lying between the muscular and mucous coats of the stomach. The cyst was emptied, and did not refill.

In the *Trans. Path. Soc.*, 1857, Mr. J. Hutchinson describes a cystic tumour of the stomach the size and shape of a walnut, situated near the pylorus, between the peritoneal and muscular coats.

H. Read (*Medical Record*, 1882) records the case of a man aged sixty-two who died after an illness of five weeks. At the autopsy a large cyst was found completely encircling the stomach. It contained clear fluid and lumps of fatty substance, with black streaks of extravasated blood.

Anderson (*British Medical Journal*, 1898) gives an account of a case of multiple cysts of the stomach and intestines, which he believed 'originated, after the fashion of dermoids, from inclusion or embryonal rests left over in the process of development of the alimentary canal.'

CHAPTER V

CANCER OF THE STOMACH

Pathological Anatomy.

CARCINOMA of the stomach is either primary or secondary. The primary form alone is of interest to the surgeon.

The classification of carcinoma which is at once the simplest and most accurate is that adopted by Perry and Shaw in their admirable paper in the Guy's Hospital Reports (1891). They describe **cylindrical carcinomata**, including the forms variously termed adeno-carcinoma, cylinder-epithelioma, or destructive adenoma, and **spheroidal carcinomata**. If the fibrous stroma is abundant, the term 'scirrhus' is applied; if scanty, the term 'medullary.' In both varieties the cells are liable to colloid degeneration. The cylindrical carcinomata are more amenable to surgical treatment. They are slower in rate of growth, and they do not develop adhesions at an early period.

Situation.—Cancer may be found at any part of the organ. Gussenbauer states that in 60 per cent. of cases the growth is in the pyloric region, in 30 per cent. in the body, and in 10 per cent. at the cardia. Lebert gives the following percentages:

Pylorus	...	...	...	54 per cent.
Lesser curvature	...	...	...	16 "
Cardia	...	...	...	9 "
Anterior wall	...	...	...	3 "
Posterior wall	...	...	...	4 "
Both walls	...	...	...	4 "
Greater curvature	...	...	...	4 "
Diffuse	...	...	...	6 "

Furnivall in 1,796 cases, compiled from various authors, found the pylorus affected in 1,110, the lesser curvature in 197, the cardiac orifice in 158, and the rest of the stomach in 331. The cardiac area is rarely affected primarily: in many cases the growth extends downwards from the œsophagus; in others the growth spreads from the body.

Extension.—Adhesions found in association with malignant

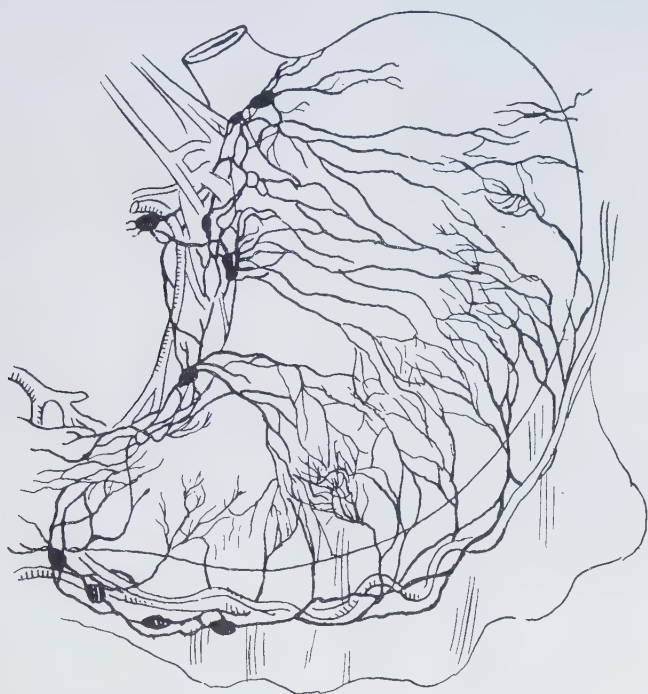


FIG. 14.—THE LYMPHATICS OF THE STOMACH. (AFTER CUNÉO.)

disease of the stomach are either simple in character—the result of local septic inflammation—or malignant. Spread of the growth away from the stomach may occur along the line of adhesions, by direct implantation upon a neighbouring surface, through the bloodvessels, or through the lymphatic vessels, which drain into glands situated (a) along the whole of the lesser curvature in large numbers; (b) along the greater curvature, chiefly near the pylorus; (c) a few in the great omentum; (d) near the head of the pancreas.

Cunéo has recently made an exhaustive examination of specimens of malignant disease of the stomach, and the



FIG. 15.—CANCER OF CARDIAC END OF STOMACH, ASSOCIATED WITH CANCER OF THE LOWER END OF THE ESOPHAGUS.
(No. 2,421, Royal College of Surgeons' Museum.)

lymphatic and glandular implication resulting therefrom. The points of especial importance from the surgical standpoint are :

1. The early and wide extension in the submucosa.
2. The tendency of cancer to drift towards the lesser curvature.
3. The habitual integrity of the duodenum.

1. **The early and wide extension in the submucosa** is well seen on making sections of the margin of the growth.

The infiltration of the mucous membrane marks the limit of induration. Beyond this there is a continuous layer of growth in the submucosa for some distance, which gradually thins off and becomes broken up, as it were, so that the growth for several centimetres is represented by scattered and isolated groups of cells. The area of infiltration of the muscular and serous layer is always less than that of the mucosa.

In order to remove the whole disease, the line of section must be at a minimum distance of 3 centimetres from the margin of the induration.

2. **The tendency of cancer to drift towards the lesser curvature.** In eleven specimens an extension to the lesser curvature

was found in nine. The stomach along the curve is hardened, and a thick, white, cordlike band is formed. Glandular enlargement is found always, for the chief lymph current is directed towards the lesser curvature. The thickening ceases generally at the point where the coronary artery reaches the stomach—that is, where the lymphatics also pass away.

When the glands along the lesser curvature are all infiltrated, the only method of extirpating them is by removing the stomach wall, to which they are attached.

The habitual integrity of the duodenum was first pointed out by Rokitansky and Brinton. Though growth rarely extends far into the duodenum, Carle and Fantino have shown that islets of growth may exceptionally be found between 2 and 3 centimetres from the pylorus. The section of the gut, in pylorotomy, should be made at least 2 centimetres from the margin of the induration.

The frequency of adhesions, glandular enlargements and metastases has been variously estimated. Gussenbauer and Winiwarter state that adhesions are present in 63 per cent. of cases of pyloric cancer; Sutton that glandular enlargements are found in 50 per cent. of cancer affecting any part of the stomach; and Gussenbauer and Winiwarter that 59 per cent. of cases show metastatic deposits. McArdle collected records of 1,342 cases of cancer of the stomach, of which 802 were limited to the pyloric region; and out of this number 496 were not associated with any important lymphatic involvement. Lindner records 28 recurrences after local removal; of these 15 were local, 12 metastatic, and



FIG. 16.—CANCER OF CARDIAC
END OF STOMACH WITH DI-
LATED ŒSOPHAGUS.

(No. 2,417, Royal College of
Surgeons' Museum.)

r glandular. These figures, which are, of course, drawn from post-mortem records, are evidence, sufficiently striking, of the local character of malignant disease of the stomach—evidence the worth of which is borne out by clinical experience, which indubitably goes to show that it is the local growth which entails the suffering and determines the death of the patient.

The surgery of carcinoma of the stomach must in the future concern itself with a much wider local removal. It seems not unlikely that, in order to secure freedom from local recurrence, the lesser curvature up to the point where the coronary artery reaches the stomach will in all cases have to be removed. By so doing, the chief lymphatic vessels and glands will be, of necessity, extirpated also.

Clinical History and Symptoms.

Cancer of the stomach affects males more commonly than females. Welch gives the proportion as five to four. At the Leeds Infirmary, during ten years, there were thirty-six males to twenty-three females. Osler in 150 cases observed 126 males and 24 females. The age of patients affected is generally between forty and sixty years of age, though no period of life is exempt. Widerhofen has recorded a case of congenital carcinoma of the stomach; Cullingworth has observed the disease in a child of five weeks; and one of us—Mayo Robson—has operated on a girl of twenty. The first symptoms of this disease are a gradual loss of appetite and wasting, generally, though not necessarily, progressive, coming on brusquely in an individual previously in good health. Concomitant with the loss of flesh is a sapping of the strength of the patient. He becomes anæmic, listless, disinclined for, and unequal to, any exertion, readily tired. Pain, or a sense of heaviness, fulness or discomfort, at a varying interval after food, is complained of early, and may lead to a feeling of dislike or disgust for food. In not a few cases, however, despite the loss of health, the appetite is unimpaired, but a wary and wise caution is observed in the taking of food, because of the known penalties which follow indulgence

Vomiting of food, little or much altered, with or without blood, or of blood alone, is noticed in most of the cases. The early symptoms, then, are very similar to those of chronic gastritis. It is, however, rare to elicit a history of very old-standing stomach disorder; the first evidences of local disease appear suddenly in persons of perfectly sound health and robust digestion. After some weeks or months a palpable tumour develops in the majority of instances, and



FIG. 17.—CANCER OF CARDIAC ORIFICE OF THE STOMACH.
(No. 2,422, Royal College of Surgeons' Museum.)

the symptoms then become pronounced. The difficulties of taking and digesting food are increased, wasting is rapid, and cachexia develops. In some cases a remarkable desiccation of the tissues, the result of the copious outpouring of fluid from the stomach wall, is observed. Thrombosis of veins, œdema of the legs, enlargement of the supraclavicular and other glands, are evidences of the approaching end.

Cases of cancer of the stomach may be **acute**, running all their course in three months; or **latent**, giving rise to no characteristic signs or symptoms, the cause of illness and

death being accidentally discovered at the autopsy. The former constitute, according to Osler, 10 per cent., and the latter 5 per cent., of all cases. Lindner and Kuttner record two cases presenting symptoms of pulmonary tubercle, in which carcinoma of the stomach was accidentally discovered at the autopsy, the lungs being healthy.

The most important of these symptoms are **pain**, **vomiting**, and the presence of a **tumour**.

Pain is the earliest and most constant symptom. At the outset of the disease complaint is made of heaviness, of undue fullness, of a feeling of oppression and distension in the epigastrium after food. Pain, limited to the gastric area or radiating to one or the other side, and occasionally penetrating to the back, soon follows. The suffering is of widely varying intensity, and comes at a shorter or longer interval after food. We have noticed in not a few cases that, as with ulcer, the earlier the onset of pain the nearer to the cardiac orifice is the growth situated. In a small minority of cases the patients assure us that, at least in the earlier stages, the taking of food has given ease, as in hyperchlorhydria. The severity of the pain is liable to considerable fluctuation in the same patient, and individual complaints vary much in their intensity. It is not often that the pain is acute and disabling.

Vomiting is almost as constant a symptom as pain. According to Osler, it is present in 85·3 per cent. of patients. The character of the vomiting depends largely upon the area of the viscus affected. In pyloric growth with obstruction and consecutive dilatation, the vomiting is copious in quantity, and the intervals between seizures are long. Food taken a few days before may be recognised by its appearance or by flavour. When the body of the stomach is affected, and the capacity of the organ is lessened, the vomiting is noticed soon after—sometimes immediately after—food has been taken, and is therefore small in quantity, becoming progressively smaller. In cases of mural cancer the vomiting is not usually an early, and from the statistics of Osler would not appear to be so pronounced a symptom.

The appearance of the vomited matter will depend upon

the length of time the food has been in the stomach, and upon the presence or absence of adventitious products, such as bile or blood. When food is ejected from a contracted stomach during or immediately after a meal, the appearance is but little altered. When the food has remained a day or two in the stomach, the vomited matters will consist of profoundly altered, ill-digested food, gastric outpourings, and probably blood. The appearance of such vomit is described by the epithet 'coffee-ground.' The odour is faint and sour;



FIG. 18.—CANCER OF PYLORUS, PRODUCING STENOSIS, IN A WOMAN AGED THIRTY-SIX.

(No. 2,411a, Royal College of Surgeons' Museum.)

when sloughing of the growth takes place, the smell may be extremely offensive and penetrating. Blood, though generally intimately mixed with the stomach contents, may be vomited alone. In a few instances it has been the first recorded symptom of gastric disease. In amount it varies from a mere tinge to a quantity sufficient to cause fainting and anæmia. Blood poured out rapidly into the stomach induces immediate vomiting; when slowly escaping, it has time to undergo partial digestion, and its appearance becomes, therefore, altered. Death rarely, if ever, results from hæmorrhage alone.

Tumour.—In the great majority of cases of cancer of the stomach a tumour can be felt at some period of the disease. This is due in part to the frequency with which the pyloric region of the stomach is attacked, and in part to the fact that the presence of a tumour entails a certain descent of the viscus, which brings the mass into the field of palpation.

It is of the first importance to remember that the presence of a tumour is evidence of large and late involvement of the stomach. It has been said by Czerny and Rindfleisch and by Kraske that when a malignant tumour of the stomach can be felt through the abdominal wall, the growth is no longer a local one, and is therefore unsuited to a radical operation. That this statement is not rigidly accurate has been proved by the experience of Kocher and other surgeons, but there can be no question but that by the time a tumour has developed a radical operation is more difficult, attended with a greater danger, and is the more likely to be followed by a speedy recurrence. The endeavours of clinicians now and in the future must be towards the perfecting of our methods of diagnosis in the days before a palpable tumour has developed.

Character of the Tumour.—For examination of the abdomen the patient must be upon the back, with the knees slightly flexed. The abdomen must be freely uncovered and exposed to a good light. A tumour, if of large size or if projecting, can occasionally be seen on inspection. Deep respiration will cause the ascent and descent of the tumour to the extent, perhaps, of some inches. Lateral movement is chiefly noted in cases of pyloric tumour, but may be equally present when the body of the stomach is implicated. The position of the tumour under the varying degrees of artificial distension of the stomach should be studied, and will give useful information. Complete emptying of the stomach will sometimes reveal an otherwise impalpable tumour. As the growth enlarges and adhesions form, its mobility becomes impeded, but the greater or lesser range of the movement affords no precise indication as to the character and extent of the adhesions. The tumour may be hard and smooth, or irregularly nodular, and may seem, when situated in or near the pylorus, to vary in size. The apparent sudden increase

is probably due to the hardening by tonic contraction of the hypertrophied muscle fibres at the pyloric antrum.

Dilatation of the stomach is the inevitable result of narrowing of the outlet. According to Osler, the commonest cause of dilatation of the stomach is malignant disease of the pylorus. The extent of the dilatation is determined by the narrowing of the exit, and upon the duration of the obstruction. All degrees of distension are met with; the stomach may even, as in one of our cases, almost fill the abdomen, and descend behind the pubes into the true pelvis. Waves of contraction will generally be seen readily; they may be

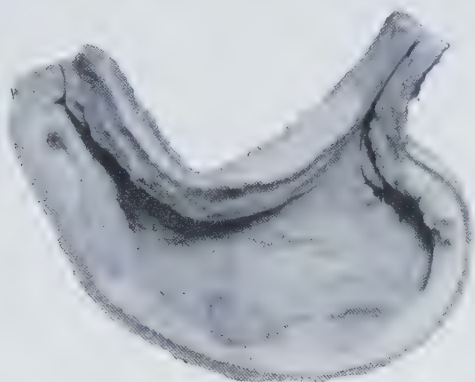


FIG. 19.—EXTREMELY SMALL STOMACH WITH DUODENAL WALLS DEPENDENT ON NEOPLASM—‘LEATHER-BOTTLE STOMACH.’

(No. 2,408, Royal College of Surgeons' Museum.)

elicited, or, if sluggish, increased by artificial distension of the organ with carbonic acid gas. Percussion and auscultation give little information of value.

In about half the cases observed, a **rise of temperature** of greater or less range will be noticed. As a rule, the fever is trivial and inconspicuous. Deep ulceration of the growth with pus formation, loculi of pus lying between an ulcer on the posterior wall, and the body of the pancreas, for example, may cause chills and high fever. The importance of **enlargement of the supraclavicular glands**, as positive evidence of carcinoma of the stomach, is pointed out by Riegel. The gland which first enlarges is situated on the left side of the neck at the posterior border of the sterno-mastoid, just above

the clavicle. The absence of glandular enlargement here is, however, void of significance. **Ascites** is occasionally present, and may be of such grossness as to mask the original disease. Hampeln and Strauss (*Deut. Med. Woch.*, 1901) have noticed the frequency with which pleural effusion on the left side is associated with carcinoma of the stomach, and consider that the association may at times be of diagnostic import. Jaundice, œdema of the legs, thrombosis of one or many veins, perforation of an ulcerating growth followed by peritonitis, and metastases in the umbilicus, abdominal wall, ribs, or elsewhere, are signs observed in the last days of the disease.

The Blood in Carcinoma of the Stomach.

The blood, as a rule, shows the changes found in secondary anæmia. Beyond this, the information given by an examination is of doubtful value. Krokiewicz states that there is no change in the red blood corpuscles. In thirteen cases digestion leucocytosis was absent. Krokiewicz agrees with Löwitt that this sign is 'of equal value with absence of HCl and presence of lactic acid.' In nearly all cases the alkalinity of the blood was lessened. Osler and McCrae come to the following conclusions:

1. Neither an increase in the leucocytes nor special variations in the forms appears to be of any moment in the diagnosis of cancer of the stomach.

2. The presence or absence of digestion leucocytosis is too uncertain to be of much assistance in diagnosis (in twenty-two cases was present in ten, absent in twelve).

According to Lindner and Kuttner, absence of digestion leucocytosis is noticed rather more frequently in malignant than in simple disease. Hartmann and Silhol (*Rev. de Chir.*, 1901, No. 2) have recently communicated to the Société de Chirurgie the results of some researches made on the blood of surgical patients. In the course of these researches they have become convinced that in cancer of the stomach an examination of the blood is more likely to prove useful than a chemical investigation of the gastric contents. The authors made particular investigations on two questions:

(a) The degree of anæmia characterized by diminution of the quantity of hæmoglobin, which may depend on the reduction of the number of globules or on the reduced proportion of hæmoglobin in their contents; and (b) the existence of leucocytosis. The presence of cancer of the stomach, it is held, is indicated by a well-marked association of decided anæmia with decided leucocytosis. Anæmia is marked less by the diminished number of globules than by (1) a diminished proportion of the hæmoglobin in the globules; (2) by irregularity in the form of the globules, indicating a profound modification of the elasticity and

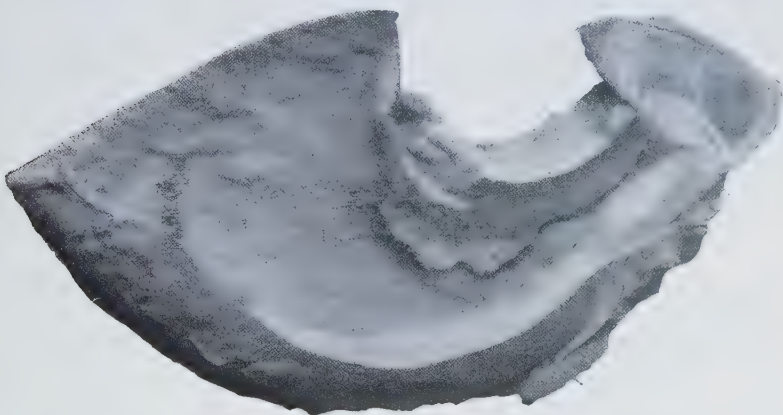


FIG. 20.—COLLOID CANCER OF PYLORUS PRODUCING STENOSIS.
(No. 2,426, Royal College of Surgeons' Museum.)

texture of the red globules; and (3) by inequality in the size of those globules that are not misshapen. The leucocytosis, to have any value as a symptomatic sign, should be very marked, and should affect especially the mono-nucleated cells.

Examination of the Stomach Contents.

In all cases of suspected cancer of the stomach, the examination of the contents is of the greatest importance. From such examination, information is afforded upon the following points:

1. The motility of the stomach.

2. The defective secretion of the gastric juice, as manifested by the diminution of free HCl.
3. The presence of adventitious products, the result of stagnation, such as lactic acid and the Oppler-Boas bacillus.
4. The presence of fragments of growth.

1. **The Motility of the Stomach** is best tested by the examination of the stomach after the administration of Ewald's breakfast. At the end of three, or at the most four, hours all traces of this meal should be absent from the stomach. If any be found, the quantity affords a rough estimate of the impairment of the motor function of the viscus. Such impairment may be due to stenosis of the pylorus, or invasion of the wall of the stomach by growth. The employment of any mechanical appliance, such as the 'deglutable, india-rubber stomach-shaped bag' of Hemmeter, is unnecessary.

The motility, according to Hemmeter, who has devoted considerable attention to the subject, is chiefly affected in disease of the orifices of the stomach. In chronic gastritis the motility, if impaired, is less so than in cancer; in neuroses the motility is increased.

2. **Defective Secretion of the Gastric Juice** was first observed by Von der Velder in 1879. The contents of the stomach after the administration of Ewald's test-breakfast are examined. It is important to emphasize the fact that a single examination of this kind is not enough. Repeated examinations are necessary in order to arrive at the truth. The reliance to be placed upon chemical examination is very differently estimated by authors. We are accustomed to consider that, if free hydrochloric acid is *permanently* absent and lactic acid is present in a patient whose symptoms are those described above, there is strong presumption in favour of a diagnosis of malignant disease. In a series of 343 cases of cancer recorded by Boas, Hammerschlag, Schneider, Rosenheim, and Osler, 89·7 per cent. showed an absence of free HCl. It will be seen from this, however, that there are 10·3 per cent. of cases in which a diagnosis based upon this point alone would be misleading. In some of these it is probable that there has been a malignant implantation upon a simple

ulcer. It is recognised as a well-established fact, to which Rosenheim first called attention, that in such cases (*ulcus carcinomatosum*) free HCl is frequently present, sometimes in excess. Hemmeter says: 'In all carcinomas that have arisen from ulcers, free HCl in normal, or even in increased, amounts may continue until death.' In others the carcinoma may be limited to a small area at the pyloric end, where there are no oxyntic or border cells, which alone, according to Heidenhain and Mall, are concerned in the production of hydrochloric acid. (In all the cases recorded by Osler, in which HCl was present, a tumour was observed.) The

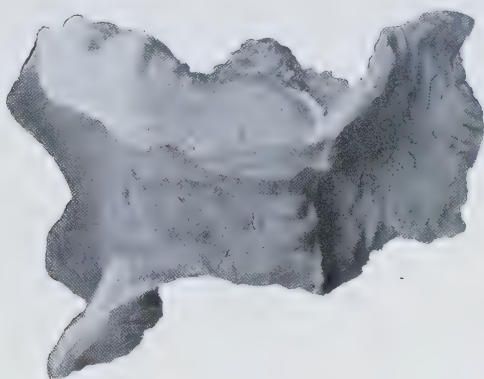


FIG. 21.—PYLORIC STENOSIS FROM ULCER WITH HYPERTROPHY OF STOMACH.
(No. 2,415, Royal College of Surgeons' Museum.)

changes occurring in the mucous membrane of the stomach in cases of cancer, and determining the alteration in the secretion, are described as (*a*) simple catarrhal inflammation, (*b*) interstitial gastritis, and (*c*) atrophy of the glands. Hammerschlag quotes certain cases in which the histological condition could be compared with the chemical findings: 'It was found that in cases of carcinoma in which hydrochloric acid was present there were very slight, or no, changes in the mucous membrane. But in cases where the HCl and the ferments were absent and lactic acid present there was found atrophy of the specific gland elements, and substitution by cylindrical epithelium or fibrous connective tissue.' This atrophy will account also for the diminished

and delayed absorption pointed out by Eichhorst, Zweifel, and others. In a condition of health, the iodine reaction should be obtained from the saliva a quarter of an hour after the administration of a cachet of 5 grains of potassium iodide. In carcinoma the reaction may be delayed an hour or more.

3. **The Presence of Adventitious Substances—Lactic Acid.**—The discussion as to the precise significance to be attached to the presence of lactic acid in the stomach contents has been given a considerable prominence in medical journalism in recent years. Lactic acid is either introduced into the stomach as such, in small quantities, or is formed by abnormal fermentative processes. It is evidence of gastric stagnation and impairment of the motor capacity, and is associated with a reduction in the amount of the digestive ferments. In order to test for it, a special meal, Boas's oatmeal and water breakfast, must be given, after carefully washing out the stomach. Uffelmann's test is employed (see p. 17).

In 268 cases of cancer quoted by Schiff, lactic acid was found in 197 cases = 73·5 per cent. Osler, in 73 cases, found lactic acid in 55 = 75·3 per cent. The presence of lactic acid is, therefore, evidence of some value. Its absence, however, cannot be held to be of any significance. Unfortunately, though so frequently present in cancer, it is not found at an early stage, and its clinical importance is therefore diminished.

The value of the chemical findings may be expressed in this manner :

If HCl is permanently absent, and lactic acid present, the evidence in favour of cancer is strong.

If HCl is permanently absent, and lactic acid is absent, the evidence is in favour of cancer.

If HCl is present, and lactic acid is present, the evidence is against malignant disease, though the possibility of *ulcus carcinomatosum* should be borne in mind.

The **Oppler-Boas bacillus**—a long, non-motile bacillus 'of the shape of a base-ball bat.' In twenty cases of malignant disease of the stomach recorded by Kaufmann, the bacilli were present in large numbers in nineteen. In sixteen recorded by Hemmeter, they were present in fourteen.

According to Schlesinger and Kaufmann (*Wien. Klin. Rundsch.*, 1895, No. 15), 'the presence of a large number of these bacilli in the stomach contents is an indication of carcinoma.' This observation is supported by Riegel. Further investigation is required before an opinion of worth can be expressed, but it would seem as though the presence of these bacilli is of the same value, as an evidence of cancer, as the presence of lactic acid. Their absence does not prejudice the diagnosis in any way. Kaufmann states that the bacilli are capable of forming lactic acid from sugar.

4. **The Presence of Fragments of Growth.**—Various means are described, and by some surgeons employed, for the purpose of obtaining fragments of growth from the stomach for microscopical investigation. Efforts in this direction are to be deprecated. Purposeful attempts to scrape or brush away portions of growth are not devoid of danger. Hemmeter uses an indiarubber stomach-tube, with a sharpened edge to the eye. This is moved slowly backwards and forwards in the stomach. A fragment of growth may in that way be caught in the opening. After ordinary lavage of the stomach, the tube should always be compressed during withdrawal, and any fragments in the tube carefully examined. If a particle of growth is thereby discovered, the diagnosis is complete. It is not likely that such a fragment will be spontaneously or by artifice detached from the growth in the earlier stages, when its discovery would be most helpful.

Diagnosis.

It cannot be too often repeated nor too strenuously emphasized that cases of cancer of the stomach should be dealt with surgically at the earliest possible moment. The evidence to which we have alluded certainly goes to show that for some length of time the disease is a purely local one. In the surgery of the breast, the tongue, the uterus, and other organs, a vast improvement has been accomplished since early diagnoses (of 'precancerous' conditions) were followed by early and extensive operations. In cases of cancer of the stomach a like, if not an equal,

improvement should be forthcoming. It is therefore necessary that the very earliest beginnings of malignant disease of this organ should be exhaustively and persistently investigated. Whenever a patient over forty years of age complains, somewhat suddenly, of indefinite symptoms of gastric uneasiness, pain, and vomiting, followed by progressive loss of weight, secondary anæmia, and so forth, the possibility of cancer should at once be recognised. As Osler has said, 'If we hear that a woman of a certain age complains of a bloody discharge from the uterus, the possibility of malignant disease is at once thought of; but how many of us consider a like grave possibility when a patient of the same age complains of stomach symptoms, perhaps with a moderately sudden onset.' As our knowledge stands at present, we cannot but recognise that our only sure method of making the diagnosis in an early stage is by an exploratory operation. Although the chemical examination of the stomach contents and the general examination of the patient may give us a very strong impression that cancer is present, our diagnosis can only be rendered certain by (1) the discovery of fragments of growth in the stomach or in the evacuated contents (probably a late sign), or (2) the digital exploration of the organ through an abdominal incision (the 'lesser abdominal section' of Mikulicz). Such a digital exploration by a competent surgeon is devoid of risk, and may, if necessary, be performed (as we have frequently performed gastrotomy) under cocaine anæsthesia. We feel, therefore, compelled very strongly to advocate, in all cases where there is any doubt, an early exploratory operation. In thus advising, we would still impress upon both physicians and surgeons the urgent need of the most painstaking and the fullest examination, in the hope that some result from their labours may, by establishing a criterion, thereby do away with the need of an 'exploratory' incision. Though such careful investigation is absolutely essential, it should not be unduly prolonged. To await the development of a 'tumour' before consenting to a diagnosis of malignant disease and advising operation is to prove one's self in ignorance of the real issues at stake. *Cancer of the stomach*

should be dealt with surgically before a tumour is clinically recognisable. In this alone lies our hope for successful treatment, and it may be also our means of establishing an early diagnosis.

In the recent admirable work on 'Cancer of the Stomach' by Osler and McCrae, the following statements are made: 'The important aid of an exploratory operation should be

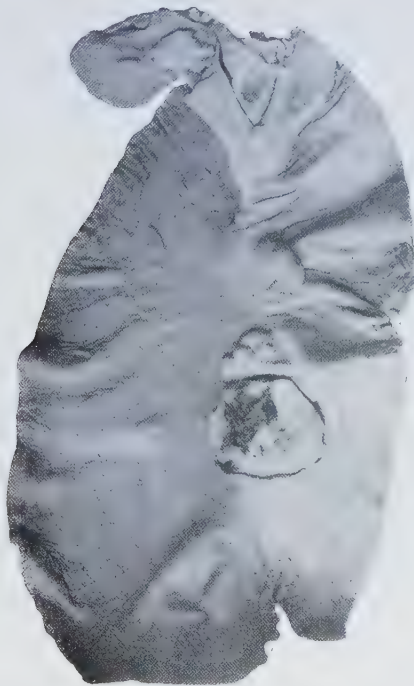


FIG. 22.—PERFORATION OF THE STOMACH DUE TO SLOUGHING CANCER.

(No. 2,407, Royal College of Surgeons' Museum.)

more frequently advised.' 'The risk is comparatively slight, and is much less than that of an undiagnosed neoplasm.' 'In a suspected case, when under treatment there is no improvement in a few weeks, an exploratory operation is justifiable.'

The exploratory examination, however, does not give information which is infallible. Several observers, Czerny, Mayo Robson, and others, have recorded cases where

malignant disease was diagnosed, in which the event proved the tumour to have been simple inflammatory thickening round a chronic ulcer. Such cases, however, are exceptional, and only afford additional support to our advocacy of the earliest possible exploration.

The Choice of Operation in Cancer of the Stomach.

1. **In Pyloric Cancer.**—Surgeons of some experience in operations upon the stomach are divided in their opinions as to the better operation in cases of malignant disease of the pylorus. On the one hand are those who, believing that a diagnosis of malignant disease cannot be made while yet the disease is local, advocate a palliative operation, gastro-enterostomy, with the idea of giving rest to the diseased area, and thereby retarding growth, as in colotomy for malignant disease of the rectum. On the other hand are those who, having been tempted to employ a radical operation in some favourable case or series of cases, are so impressed with its advantages that they become apostles of a broader creed, and advocate local extirpation. Our opinion emphatically is that *in all cases, whenever possible, a radical operation should be attempted*. Under present conditions of diagnosis, the probability is that, when a patient is submitted to operation, gastro-enterostomy is, in general, a safer operation than pylorotomy. But although the comfort and sense of well-being of the patient may improve very decidedly for a time after the former operation, the tumour is still slowly enlarging in size, and will eventually cause death. How much of the general ill-health, cachexia, and so forth, are induced by absorption from the growth, by necrotic changes in its mass, by ulceration and hæmorrhages upon the surface, is quite unknown, but one may presume that such influences are not trivial. Krokiewicz and Pilliet believe, indeed, that cancer cachexia is the result of intoxication with the by-products of metabolism of the cancer cells. A local extirpation, then, even if followed by a recurrence, will probably prolong life for a greater period and in greater comfort than a gastro-enterostomy. It was doubtless an opinion similar to this which led Terrier to remark that

'the best form of gastro-enterostomy was done after removal of the pylorus.' But increasing experience in the most competent hands all tends to show that in properly-selected cases pylorectomy is *not* an operation of very grave risk, and *is* an operation of generous promise.

We very much doubt whether the discussion of this question is materially helped by any reference to statistics. The contrast in tabular form of the mortality of gastro-enterostomy and partial gastrectomy is most futile and misleading. To show how absurd this fettering of our practice to statistics may be, we may quote the figures of Carle and Fantino, who have an operation mortality of about 40 per cent. in gastro-enterostomy, and of 20 per cent. in pylorectomy. Wölfler tabulated 219 cases of operation for cancer performed between the years 1888 and 1896. The death-rate in cases of gastro-enterostomy was 36 per cent., in pylorectomy 31·2 per cent. The rate of mortality must be very largely a question of the age and condition of the patient and the duration and stage of the disease. In an early case of pyloric cancer, gastro-enterostomy has a small mortality—perhaps approaching in insignificance the mortality in cases of simple stenosis; in moderately advanced or late stages the mortality is very large.

Partial gastrectomy in the early days of its employment was an exceedingly serious operation, with an appalling death-rate. Latterly the mortality is seen to be a gradually, but persistently, diminishing one. In comparing and contrasting the two operations, we may refer to the following points :

(a) The prolongation of life.

(b) The general condition of the patient subsequently.

(a) **The Prolongation of Life.**—Krönlein has calculated that a patient suffering from gastric cancer, still operable, but not submitted to resection, will live 209 days. This is less by at least a year than the average duration of life after resection. Moreover, after resection there is always the chance—a slender one, perhaps, but still a chance—of a permanent cure. The following list of cases will show that a long existence after resection is not so rare as is supposed :

Wölfler (*Berl. Klin. Wochensch.*, 1896), after personal inquiry, had records of fourteen cases who were alive or had lived over two years ; of three (Czerny, Hahn, Gersuny) who had lived more than four years ; of four (Billroth, Kocher, Maydl, Wölfler) who had lived more than five years ; of one case of sarcoma alive after six years ; and of two (Kocher, Rati-moff) alive after eight years. To these Guinard (*Thèse de Paris*, 1898) adds one case (Montaz) alive after two years ; one case (Lauenstein) alive after two years ; one case (Peug-niez) alive after four years ; one case (Carle) alive after five years ; and three (Schuchardt, Funke, Hochenegg) who had lived between two and three years. At the *Deutsch. Gesellsch. f. Chir.*, 1898, Krönlein recorded two cases alive and well after four years ; Czerny, three cases after two and a half, seven, and eight years (the last the case of sarcoma above referred to) ; Löbker, two cases after five and seven years ; Hahn, one case after seven and one case after four years ; and Hacker, one case after six years, and a case of Billroth's after eight years. Jessop has one patient still living after a pylorotomy performed for malignant disease on December 28, 1891. Such a list is most encouraging. The pro-longation of life, however, is not the sole advantage accruing from the more radical measure. The greater comfort, the brighter health, the better nutrition, are the all-important benefits. As Mikulicz says : ' If we do not prolong life by a single day, the operation is still justified in my eyes.' The compensations, therefore, for the greater risk run in the more severe operation are the increased prolongation of life and the greater comfort of the lengthened days.

(b) **The General Condition of the Patient subsequent to Opera-tion** is without question in all respects better after gastrec-tomy, especially after end-to-end suture. For, in the first place, the absorption of the by-products of metabolism in the tumour is altogether done away with ; and, in the second, both gastric and intestinal digestion and absorption are less disturbed. Mintz (quoted by Guinard) has shown that, what-ever the condition of the gastric juice may have been previous to operation, after gastro-enterostomy the secretion rapidly diminishes, and finally ceases, and after gastrectomy remains

in the same quantity and condition as before the operation. Jöslin (*Berl. Klin. Wochensch.*, 1897), working under the direction of Ewald, found that after gastro-enterostomy the intestinal absorption of albumin was but little modified, but that the absorption of fats and hydrocarbons was considerably diminished. Heinscheimer (*Mitt. aus den Grenzgebiet. der Med. und Chir.*, 1896) attributes this marked loss of the power of absorption to the cutting off of the duodenal loop. Under normal conditions, the chyme passing into the duodenum, a portion of the canal where the intestinal circulation is languid, has ample time to mix thoroughly with the bile and pancreatic juice, and is thereby rendered more easy of absorption. Hartmann and Soupault (*Rev. de Chirurgie*, vol. xix.) state that after gastro-enterostomy patients *never* recover their former health and vigour.

The observations of Jöslin and Heinscheimer constitute important arguments in favour of end-to-end approximation after removal of portions of the stomach. Of the methods in vogue, two—Kocher's and Mayo Robson's (bone bobbin)—are, we think, the best.

There are certain cases where the argument against pylorectomy may be considered to be valid. These are:

- (a) Cases in which extensive and extremely dense adhesions (to liver, pancreas, gall-bladder, etc.) are present.
- (b) Cases in which a widespread enlargement of lymphatic glands is found.
- (c) Cases in which secondary deposits in the liver or elsewhere are seen.

(a) Adhesions interfere with the success of a radical operation in two ways: They increase the physical difficulties of the operation; and, being channels along which infection drifts, they are presumptive evidence of widespread disease.

(b) Widespread enlargement of glands, if malignant in character, forbids local extirpation of a gastric growth. If the glands along the curvatures of the stomach in the greater and lesser omenta are alone involved, they may be successfully removed at the same time as the growth. Kader, in eight gastrectomies, found the chief enlargement of the

glands in the omentum, below the pylorus. When the glands at the head of the pancreas are widely involved, any attempt at their removal is dangerous, and almost necessarily incomplete. An enlargement, however, is not necessarily malignant. Many observers have noticed in this region, as in the breast (Halsted), a simple inflammatory enlargement of glands, in association with malignant disease of the tributary area. Malignant glands are generally much harder than the inflammatory.

(c) Before undertaking any operation involving local removal of growth, a very careful examination should be made for secondary growths. Small button-shaped nodules may be felt on the upper surface of the liver when the pyloric growth is hardly bigger than a signet-ring. When such secondary growths are present a radical operation is futile.

2. **In Mural Cancer.**—The same remarks apply to cancer of the wall of the stomach. In such cases obstruction may be absent. Diagnosis is therefore not so early, so that when the abdomen is opened a large area of stomach may already be affected. Even if no narrowing is produced, a gastro-enterostomy, by determining rest, will assuage pain and lessen the rate of growth. A complete local removal, however, is the ideal for whose attainment we should strive. The extent of such removal will vary from the minimum of an hour-glass stomach to the maximum of a general infiltration of both walls. The surgeon will be guided in a decision by the extent of such growth and by his personal capacity and preference. It is, we think, possibly open to question whether a complete gastrectomy is a scientific operation or a brilliant exploit in surgical gymnastics. The records of the cases so far performed are certainly far better than could have been anticipated.

In all cases of local excision, whether in the body of the stomach or at the pylorus, a wide healthy area surrounding the growth should be removed. Experience goes forcibly to show that it is from local recurrence that patients die, even when the incisions have been made, as it would seem, wide of the disease. The direction of the spread of the growth should be carefully noticed. If the growth is spreading

circularly, in the line of the vessels, it shows little tendency to recur after removal; if it is spreading transversely along the curvatures, there is said to be a strong tendency to recurrence (Mayo). The importance of Cunéo's observations, already referred to (p. 62), may be again emphasized.

3. **In Growth at the Cardiac End.**—Only palliative operations are possible when the growth involves the cardiac orifice and the adjacent portion of the stomach. Levy has, indeed, planned an operation, and practised it upon the cadaver, for the purpose of removing such a growth (*Langenbeck Archiv.*, 1898), but, so far as we know, a procedure of this kind has only once been attempted during life.

This was by Mikulicz, who removed a primary carcinoma of the cardia and a portion of the œsophagus between 3 and 4 centimetres in length. The operation was exceedingly difficult on account of spreading of the growth towards the pancreas and implication of the retroperitoneal lymphatic glands. The patient died of peritonitis. Mikulicz expresses the hope that not only carcinoma of the cardia, but even of the lower end of the œsophagus, may prove within the safe reach of a capable surgeon.

Krehl has shown that in dogs the two pneumogastrics may be completely destroyed at the lower end of the œsophagus without interfering in any degree with the processes of digestion.

In all cases, gastrostomy should be performed at the earliest moment after the diagnosis is assured.

CHAPTER VI

SARCOMA OF THE STOMACH

SARCOMA of the stomach may be **primary** or **secondary**. The former is the more frequent, and alone is of interest to the surgeon. Primary sarcoma was formerly considered an extremely rare disease—a pathological curiosity, in fact; but recent observation makes it probable that not a few cases of so-called ‘cancer’ are in reality examples of true sarcoma. Perry and Shaw, in their well-known paper (Guy’s Hospital Report, 1892), found that four of fifty museum specimens of malignant disease of this organ were sarcomata. Schlesinger (*Zeitsch. f. Klin. Med.*, 1897) collected the records of thirty cases. Fenwick, in November, 1900 (*Lancet*), makes mention of sixty, and of these fifty-three were recorded at sufficient length to permit of analysis and classification.

The following pathological varieties are recognised :

1. **Round-celled Sarcoma** (‘**Lympho-sarcoma**’).—Thirty-three of the fifty-three are of this form. The tumour is generally found in the pyloric portion of the stomach, giving rise to a considerable local thickening and induration, which shades off into tough bands along the curvatures. The growth may project boldly upon the surface, or may form a solid stiff plate in the thickness of the stomach wall. The pyloric orifice is not narrowed, but as a rule, according to Fenwick, the rigidity of its tissues renders it patent, and the valve incompetent rather than contracted. The disease commences in the submucosa, and extends to the muscular coat; the mucosa is stretched by the growth, thinned, and at times ulcerated. It has been shown (Redtenbacher, *Jahrbuch der Wiener Krankenaustalten*, 1894) that a diffuse infiltration of

round cells in the mucosa extends some distance beyond the obvious limits of the disease.

The following are typical cases recorded in the literature :

Hadden (*Pathological Society's Transactions*, vol. xxxvii., 1886) describes a case of lympho-sarcoma of the stomach. There was 'a globular tumour in the anterior wall of the stomach, close to the lesser curvature, rather nearer the pyloric orifice than the cardiac orifice. On the inner surface of the stomach, corresponding to the mass seen externally, a triangular ulcer, $1\frac{3}{4}$ inches in its largest measurement, was found. The ulcer led by a free opening into the centre of the tumour for a distance of $1\frac{1}{2}$ inches. This excavation was roughly globular, and its external surface fairly smooth. On microscopic examination, the tumour was found to be composed of small round nucleated cells contained in a reticular stroma. In fact, the growth seemed to be a lympho-sarcoma, but its peculiarities consisted in a papillary or alveolar arrangement; and in the centre of most of these alveoli a small vessel could be seen.' This case illustrates the tendency of these growths to soften, ulcerate, and break down.

Schoff (*Cent. f. Chir.*, 1899, p. 1163).—In this female patient there was a large movable tumour of the size of a child's head in the abdomen. The abdomen was opened, numerous glands found in the small and large omenta, and a tumour occupying the greater part of the stomach. The stomach was removed two fingers' breadth from the cardia, and one from the pylorus, and the cut ends of viscus stitched together. The tumour was seen on examination to occupy the lower two-thirds of the portion of stomach removed, was hard and nodular, and microscopically was lympho-sarcoma. The patient recovered from the operation, and was well without recurrence twelve months later.

Finlayson (*British Medical Journal*, vol. ii., 1899, p. 1535) records an example of round-celled sarcoma in a boy three and a half years old. The tumour was not diagnosed during life. The chief symptom was a profound anæmia. There was a slight but continuous pyrexia. The child sank gradually, and died, the growth being found post-mortem.

2. **Spindle-celled Sarcoma.**—Twelve of the fifty-three are of

this variety. This form of growth is generally seen as a circumscribed tumour near the greater curvature of the stomach; it is often pedunculated, and when growing on the posterior surface hangs in, and by its enlarging may obliterate, the lesser sac of the peritonæum. The larger the mass formed, the softer, as a rule, is the tissue composing it. Cystic or gelatinous degeneration is not seldom observed. The following are examples:

Billroth successfully removed a cystic sarcoma attached to the greater curvature and the contiguous portions of the anterior and posterior walls.

Hartley (*Annals of Surgery*, vol. xxiii., 1896, p. 609).—The tumour occurred in a woman fifty-four years of age. Except for long-standing dyspepsia, she had been in perfect health until five years before. At that time she, without apparent cause, vomited a large amount of 'coffee-ground' material. For four years she remained without symptoms, then had another attack of vomiting of coffee-ground material and blood and clots. Pain in the back was now complained of, and a tumour was noticed in the epigastrium. On physical examination, there was felt in the left lumbar and umbilical regions a rounded tumour, hard, elastic, freely movable. A tentative diagnosis of movable kidney was made, but was, when the patient was examined under ether, considered doubtful. An incision was made in the left linea semilunaris, and the tumour was felt behind the transverse mesocolon in the left splenic region. The mesocolon was torn through, and the tumour exposed, lying in the lesser sac. The growth was seen to spring from the posterior wall of the stomach by a pedicle $1\frac{1}{2}$ inches in diameter. The stomach was pulled well forwards, grasped below the pedicle; its wall was cut through entirely around the pedicle, removing a portion of its wall with the tumour. The stomach opening was closed. The pathological report was: 'Pear-shaped tumour $15 \times 10 \times 8$ centimetres. Its surface is smooth, but nodular. The tumour is cystic. An area of stomach wall 5×4 centimetres has been removed with the tumour. Sections of the tumour show the typical appearance of spindle-celled sarcoma.'

Cantwell (*Annals of Surgery*, vol. ii., 1899, p. 596).—A female

patient, aged fifty-two, complained of a large abdominal tumour presenting no signs or symptoms save those of weight and pressure. On opening the abdomen, an immense mass, covered by omentum and mesentery, presented. An opening was made through its envelopes down to the tumour proper, which was so soft as to verge on the gelatinous; from its whole surface there oozed bloody serum. It was not until the tumour was carefully enucleated and lifted from its bed that it was seen to arise from the posterior wall of the stomach down to its greater curvature. The weight had dragged the stomach down to a point several inches lower than its ordinary position. The growth with part of the stomach was cut away with scissors, and the wound closed with two tiers of sutures. On the tenth day a parotitis occurred, as in Christy Wilson's case, but subsided. The tumour weighed 12 pounds, and 5 inches square of the mucous membrane of the stomach had to be removed. Recurrence was noticed eight months after operation.

3 and 4. **Myosarcoma** (five cases of the fifty-three) and **Angiosarcoma** (two of the fifty-three) are unusual varieties. The former are characterized by a remarkable tendency to extravagant hæmorrhage, which imperils the patient's life. An example of the latter was successfully removed by Kosinski (*Deutsch. Gesellsch. f. Chir.*, 1892).

All these varieties exhibit a marked proneness to the formation of metastatic deposits in the skin or elsewhere. A small nodule has been on several occasions noticed at the umbilicus. An example of melanotic sarcoma, with deposits in the skin, is preserved in the Hunterian Museum at the Royal College of Surgeons; the visceral deposit is probably secondary.

Symptoms.

The symptoms of sarcoma very closely resemble those of carcinoma. One of the earliest and most striking features is a progressive emaciation with failure of physical power. Anæmia is almost constant, and is often profound, suggesting a diagnosis of 'pernicious anæmia.' There is often a trivial but continuous pyrexia, and persisting albuminuria is not

seldom observed. In some cases—those, for example, of Baldy and Cantwell—symptoms were almost or entirely lacking. A tumour may be, but often is not, felt. Dilatation of the stomach and vomiting are infrequent. When vomiting is present, blood, either fresh or altered, is constantly noticed, and the blood may be found on careful examination of the stools. Kundrat places reliance as a diagnostic sign upon ‘enlargement of the tonsils with occasional swelling and ulceration of the follicles of the tongue.’ The chemical findings are similar to those in carcinoma. The HCl is absent from an early stage. Lactic acid and the Oppler-Boas bacilli are found (Schlesinger, *Zeit. f. Klin. Med.*, vol. xxxii.).

A study of recorded cases shows that small round-celled sarcoma is generally diagnosed as carcinoma of the stomach, whereas spindle-celled growths are only recognised at the time of operation as having their origin in that viscus.

CHAPTER VII

GASTRIC ULCER

ALTHOUGH in its earlier phases gastric ulcer comes under the care of the physician, many of the complications to which it gives rise demand surgical intervention, and, in fact, can be treated satisfactorily only by surgical means. This being so, it is necessary that we should look at the subject before taking particular note of those conditions which specially call for surgical intervention.

For the present passing over malignant, tubercular, and syphilitic ulcers, the special form of ulceration which produces the complications calling for surgical treatment is the simple ulcer of Cruveilhier, and to this may be added the simple erosion of the mucous membrane described by Dieulafoy, which at times leads to serious, or even fatal, hæmorrhage.

Although for clinical purposes it is necessary to distinguish two distinct forms of ulceration of the stomach, acute and chronic, which appear to be separate and characteristic, there are so many intermediate stages that it is questionable whether or no these classes are so distinct as their extreme varieties would seem to indicate.

In the classification of ordinary ulcer of the stomach, the following varieties seem to us to include the various forms :

I. Erosions.

Of these Dieulafoy has described two varieties :

(a) **Simple Erosions**, consisting apparently of mere abrasions of the surface epithelium, which, though so small as to be

scarcely perceptible to the naked eye, may give rise to most alarming hæmorrhage. On the post-mortem table abrasions of this kind may be easily overlooked; but as seen when hæmorrhage is going on, the mucous membrane seems to be studded with numerous bleeding-points.



FIG. 23.—MULTIPLE
ROUND ULCERS.

(No. 2,400, Royal College
of Surgeons' Museum.)

(b) **Exulceratio Simplex**.—In the form to which Dieulafoy applied this term the lesions are rather more extensive, and the surface layers are removed to such an extent that the arterioles running under the muscularis mucosæ are exposed. This form of ulceration may give rise to terrible hæmorrhages that may prove rapidly fatal unless arrested by treatment.

II. Simple Ulcer.

The second form, described by Cruveilhier, includes :

(a) The **Acute Round Ulcer**, which is most frequently found in women, often in chlorotic young women, and which is apt to be complicated by profuse hæmorrhage and by perforation.

(b) The **Chronic Form**, irregular in outline, associated with thickening of the edges, and frequently found in men—according to Dr. Seymour Taylor, in the proportion of 72 per cent. in males to 28 per cent. in females. This form is one which gives rise to the greater number of complications with which the surgeon has to deal.

According to our experience in the operating theatre, this chronic form of ulcer occurs very frequently in women, and, in fact, we have operated on quite as many cases in the female as in the male. Probably there is no hard-and-fast line of demarcation between acute and chronic ulcers, just as it is difficult to define the boundary between simple erosions and the 'exulceratio simplex' of Dieulafoy. Notwithstanding that there has been much investigation into the subject, and that many experiments have been made,

with the view of elucidating the pathology of gastric ulceration, the question can scarcely be held as settled, nor can any of the theories at present put forward be supposed to account for all cases. It is not our intention to discuss, or even to state, all the theories supported by the different authorities; but we shall mention one or two which seem to afford a likely explanation for a large proportion of cases.

It is well known that in many apparently functional

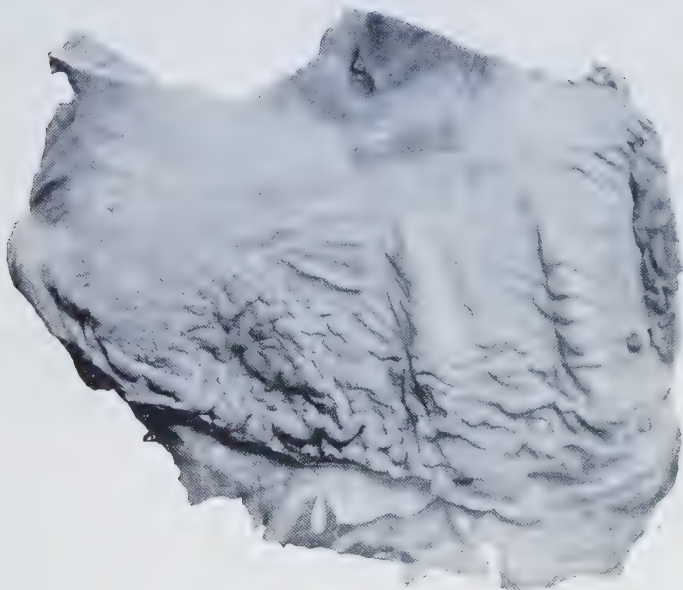


FIG. 24.—ACUTE ROUND ULCERS IN THE STOMACH OF A WOMAN AGED TWENTY.

Death from perforation in forty hours. The perforation is very small, on the anterior wall close to the middle of the lesser curvature, and there is another ulcer nearer the cardiac orifice. (No. 2,395a, Royal College of Surgeons' Museum.)

disturbances of the stomach slight abrasions of the mucous membrane occur, which heal readily enough under ordinary circumstances. Many experimenters have produced similar abrasions in animals, and have found them to heal equally rapidly by proliferation from the epithelial margins of the sores so formed. Quincke and Daettwyler (*Correspondenzblatt für Schweizer Aertze*, 1875, p. 101), in addition to injuring the mucous membrane of the stomach, rendered

the animals experimented on anæmic by bleeding them, and then found that the abrasions did not spontaneously heal, but continued to form distinct ulcers, and in some cases even went on to perforation. Another experimenter (Silbermann, *Deutsche Med. Woch.*, 1886, No. 29) produced hæmoglobinuria, and found a similar, though less marked, result follow the production of abrasions of the gastric mucous membrane. It is possible that these experiments explain the frequency with which simple ulcer of the stomach is found in anæmic young women, while the latter series may account for those obscure cases of perforating ulcer of the duodenum following on extensive burns, since it is well known that in a fair proportion of cases of burning there is extensive destruction of red blood corpuscles, as shown by the existence of hæmoglobinuria. More recently, the recognition of the fact that in a very large proportion of all cases of gastric ulcer the gastric juice is hyperacid has led to a belief that this is the chief factor in the production of the lesion. It is quite possible that the hyperacidity may, in the presence of other conditions, determine the production of ulceration; but since in many other morbid conditions of the stomach the gastric juice may have an excess of hydrochloric acid, and yet no ulceration be induced, it can only be considered as one of the contributing causes. Moreover, well-marked cases of gastric ulceration have been put on record in which there was not only a deficiency, but even an entire absence, of hydrochloric acid, and there has been no evidence brought forward to show that the hyperacidity is not an effect rather than the cause of the ulceration.

None of the other theories advanced have, so far as we know, any strong basis or support in clinical observations, but seem to be founded on the production of conditions in the laboratory which occur very infrequently, if at all, in man. Notably is this the case with the theory that ulcers mostly arise in connection with the results of embolism of the smaller arteries in the stomach; for even if solid particles be injected into the general blood-stream in animals, the stomach is one of the organs in which they are least commonly found.

The acute simple ulcer differs very materially in shape and general appearance from the chronic ulcer. As a rule, in the acute variety the ulcer is small, round, or oval, and has the appearance of being punched out; its walls are not—at least, post-mortem—infiltrated to any marked extent, and the base, though smooth, does not usually show much evidence of granulations, the submucous, muscular, or serous coat being laid bare. The general shape of the ulcer is that of a truncated cone, with its base towards the interior of the stomach, the layers from within outwards being successively

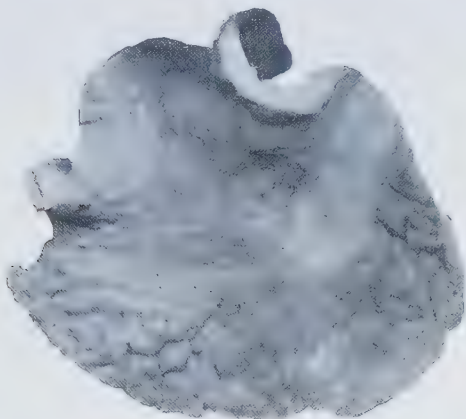


FIG. 25.—A SMALL, UNIVERSALLY ULCERATED STOMACH, 5 INCHES LONG, 6 INCHES IN WIDEST CIRCUMFERENCE, WITH THE COATS THREE OR FOUR LINES THICK.

From an old gentleman of seventy, accustomed to take up to 3ii of Colchicum wine for gout. Although he abstained for nine months before death he had incessant pain and vomiting.

less destroyed. This has been supposed to give great support to the theory that the acute ulcer takes origin from some interference with the blood-supply; but Dr. Soltau Fenwick has shown that, even if all the coats of the stomach are equally destroyed by cautery, the ulcer ultimately assumes the usual funnel shape. Up to the margin of the ulcer the mucous membrane is normal in all respects and quite supple. On the other hand, the chronic ulcer is not infrequently large, and is usually irregular in shape; the margins are hard, indurated, and infiltrated, and the base shows evidences of cicatricial processes. Much more frequently also in this

variety the peritoneal coat is thickened, and adhesions to neighbouring viscera, especially the liver and pancreas, form, and it is not uncommon for the base to be formed by the tissues of one of these organs. In chronic ulcer the long axis is, as a rule, transversely placed, but this is by no means invariable. The mucous membrane for some space round the ulcerated area is thickened and infiltrated, and according to Dr. Fenwick ('Ulcer of the Stomach and Duodenum,' London, 1900) there is not infrequently varicosity of the small venules in the immediate neighbourhood.

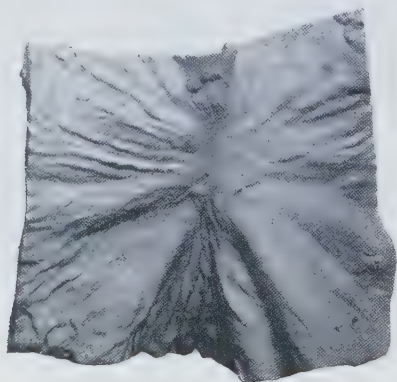


FIG. 26.—CHRONIC ULCER OF STOMACH SHOWING CHARACTERISTIC PUCKERING AND CONTRACTION THE RESULT OF HEALING.

(No. 2,402a, Royal College of Surgeons' Museum.)

Acute ulcer is much more frequently multiple than is the chronic ulcer—probably half the cases of acute ulceration present more than one—while in the case of chronic ulceration it is comparatively rare to find multiple ulcers, though at times the shape of that found is suggestive of the coalescence of several ulcerated areas.

The different regions of the stomach are very variously affected in this disease. According to Brinton, in 43 cases out of 100 the ulcer is situated on the posterior surface, in 27 at the lesser curvature, in 16 at the pylorus, in 6 on both anterior and posterior surfaces, in 4 on the anterior surface alone, in 2 at the cardiac end, and in 2 on the greater curvature.

Welch gives 793 cases distributed as follows: 235 on the

posterior surface, 288 on the lesser curvature, 95 at the pylorus, 96 on the anterior wall, 50 at the cardia, 29 at the fundus, and 27 on the greater curvature.

Dr. Fenwick has collected 1,015 cases, and gives the

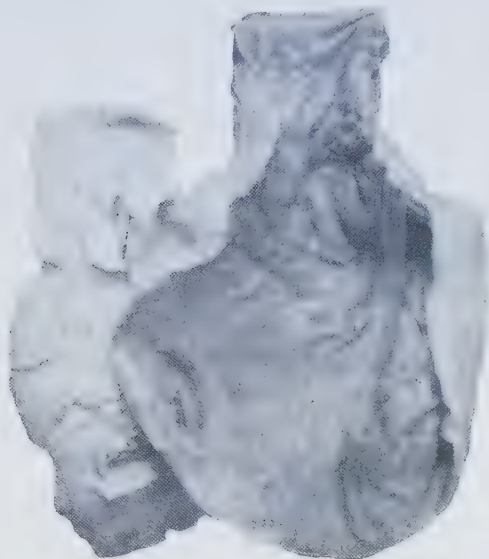


FIG. 27.—ULCER MIDWAY BETWEEN CARDIAC AND PYLORIC ORIFICES, NEAR LESSER CURVATURE, ERODING SPLENIC ARTERY, ON WHICH IS A SMALL ANEURYSMAL DILATATION.

From a man of fifty-six. Death from hæmorrhage. (No. 2,401a, Royal College of Surgeons' Museum.)

following table showing the relative frequency of the disease in different regions of the stomach :

	Cases.	Per cent.
Pylorus	158	15·6
Lesser curvature	366	36
Posterior surface	254	25
Cardia	80	7·9
Great curvature	42	4·14
Anterior surface	82	8
Fundus	33	3·3

It is noteworthy, however, that, of his own cases, the chronic and acute ulcers (which are not distinguished in the above table) markedly differ in their distribution. Of

109 cases, 70 chronic ulcers were distributed thus: 53 in the pyloric region, 7 in the middle zone of the stomach, and 10 towards the cardiac end; the remaining 39, the acute ulcers, had the following distribution: 13 in the pyloric, 14 in the middle, and 12 in the cardiac region. Thus, 75 per cent. of the chronic ulcers were in the pyloric region, while in acute ulceration all three divisions were fairly equally affected.

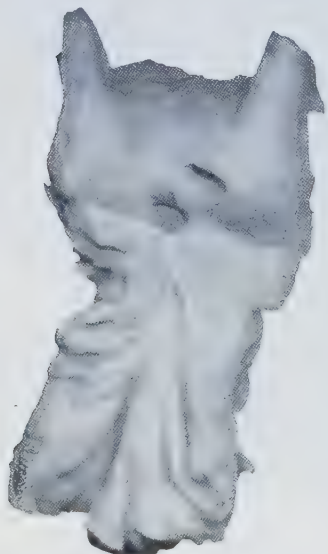


FIG. 28.—PYLORIC ULCER SHOWING SMALL PERFORATION, AND ANOTHER CAUSING CONTRACTION OF PYLORUS.

(No. 2,398, Royal College of Surgeons' Museum.)

This distribution of ulcers generally, and especially of the chronic variety, has, as will be seen later, a most important bearing on the question of surgical intervention in cases with a long-continued history of gastric trouble.

The questions of the age and sex of the patient are of great importance in helping to a decision as to the character, and therefore the site, of the lesion, and require attention here.

Judging from clinical experience rather than from post-mortem records, it would appear that ulceration of the stomach occurs about three times as frequently in women as in men. On the other hand, pathological reports would lead one to suppose that gastric ulcers were much less disproportionately distributed between the sexes; thus, Welch gives the relative proportions as 40 per cent. in men and 60 per cent. in women, while out of 2,031 cases of open ulcer collected by Fenwick, 1,227 occurred in women and 804 in men. This apparent discrepancy is probably to be accounted for by the fact that women are more liable to suffer from the acute affection, while the chronic process occurs more frequently in men, and is more often fatal.

That this is the true explanation cannot at present be definitely stated, since in most collected cases no distinction is made between acute and chronic ulcers; but an examination of 89 cases made by Fenwick points so strongly in this direction that there can be little doubt but that this view will ultimately be established. Of his 89 cases, 30 were acute, and only 10 per cent. occurred in men, while 59 were chronic ulcers, and of these almost 73 per cent. were in men.

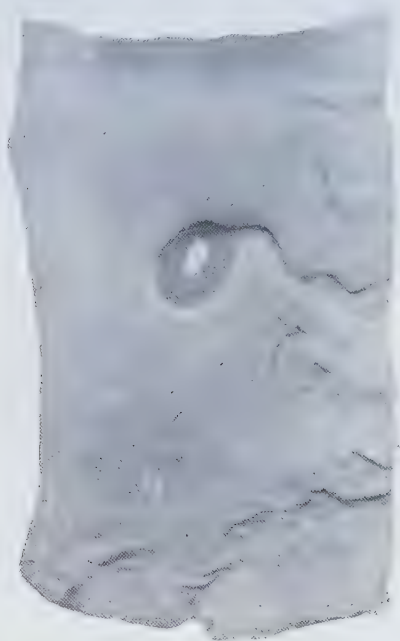


FIG. 29.—A PERFORATING ROUND ULCER CAUSING DEATH IN A LADY TWENTY-TWO YEARS OF AGE.

(No. 2,396, Royal College of Surgeons' Museum.)

Dr. Seymour Taylor gives almost identical figures in chronic ulcer, viz., 72 per cent. in men and 28 per cent. in women.

With regard to age incidence, all authorities are agreed that gastric ulcer is much more frequently found in the third decade; but here also it should be noted that according to the sex the age incidence varies, for while 75 per cent. of cases of gastric ulcer in women are found before the age of thirty, in men only about 25 per cent. occur before that

age. It is notable also that, in the statistics referred to above, in which a distinction is made between acute and chronic ulcers, it was found that of the acute ulcers over 70 per cent. occurred within the first thirty years of life, while in chronic ulceration less than 7 per cent. occurred within that period.

Though it may be granted that the numbers with which this analysis deals are too few to enable one to dogmatize, yet the variations are too great to be accounted for on the supposition of mere coincidence.

It seems, therefore, fair to conclude that chronic ulcera-

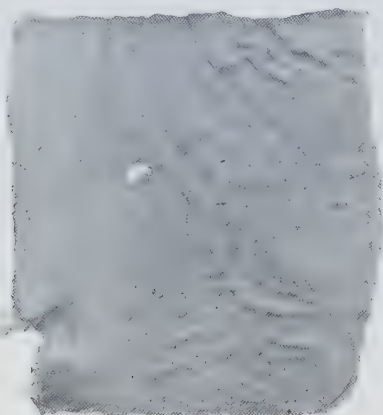


FIG. 30.—‘SIMPLE CHRONIC ULCER’ OF CRUVEILHIER, OR THE ‘PERFORATING ULCER’ OF ROKITANSKY.

From a girl of seventeen. The ulcer is situated on the anterior wall of the stomach 2 inches from the cardiac orifice. (No. 2,395, Royal College of Surgeons’ Museum.)

tion is much more frequently present in men, and is proportionately much more fatal in its effects than is acute ulceration of the stomach ; and that the former is a disease of middle or advanced age, as contrasted with the latter, which, as a rule, occurs within the first three decades. Along with this, however, must go the qualification that chronic ulcer is often a very slowly progressive affection, and that it may last for over thirty years.

Although the following complications are common to both forms of ulcer, certain of them are of greater frequency in

the one than in the other. For instance, the acute round ulcer is more frequently followed by violent hæmorrhage and by perforation than the chronic ulcer, yet the latter is also liable to be followed by both. On the other hand, the chronic ulcer is more frequently followed by cicatricial contraction of the pylorus, with subsequent dilatation of the stomach, and by perigastritis leading to disabling adhesions; also by hour-glass contraction, fistula, and tumour of the pylorus or of the stomach, serious atonic motor deficiency, severe gastralgia with uncontrollable vomiting, cancer of the pylorus, tetany, acute and chronic pancreatitis, abscess of the liver, chronic hepatitis, profound anæmia (resembling the pernicious form), stricture of the bile-ducts, jaundice, catarrh of the gall-bladder, and other complications depending on invasion of the neighbouring organs. Both forms are accompanied by pain, by great loss of flesh and strength, and at times by subphrenic abscess.

Thus, it will be at once perceived that surgery is intimately concerned with, and, in fact, affords the only effectual treatment in, many of these complications.

Prognosis.

According to Lebert, as quoted by Dr. Dreschfield, death occurs in 10 per cent. of all ulcers, $6\frac{1}{2}$ per cent. occurring from perforation, and $3\frac{1}{2}$ per cent. from hæmorrhage. Habershon says that perforation occurs in 18 per cent. of all cases of ulcer of the stomach, and Brinton in 15 per cent., to which must be added the mortality from hæmorrhage, which, according to Müller, is 11 per cent.



FIG. 31. — CHRONIC ULCER OF POSTERIOR WALL OF STOMACH ERODING PANCREAS.

(No. 2,399, Royal College of Surgeons' Museum.)

of all cases of ulcer, the average of all authorities being 5 per cent. ; so that, allowing 15 per cent. to represent the mortality from perforation and 5 per cent. that from hæmorrhage, the mortality of gastric ulcer treated medically is at least 20 per cent. But Tricomi (*Riforma Medica*, February, 1899) gives even a larger mortality as an argument in support of his views to treat all obstinate cases of gastric ulcer surgically ; and Brinton gives the mortality from all causes in gastric ulcer at 50 per cent.

It is probable, however, that none of the series of statistics which have been made adequately or accurately gives the mortality, since practically in none is any account taken of the large number of deaths due to the effects of those complications which run a chronic course. This is the more likely to occur, since naturally the larger statistics are compiled from the records of general hospitals ; and it is unlikely that anything like a large proportion of cases, such as we refer to, should die in hospital. It is probable, therefore, that 20 per cent. is under, rather than above, the true mortality ; and it is just possible that the following table (quoted from Einhorn, 'Diseases of the Stomach'), cited from Debove and Rémond, adequately represents the truth :

100 cases :

Perfect cure	50
Perforation and peritonitis	13
Foudroyant hæmatemesis	5
Pulmonary tuberculosis	20
Inanition	5
Different complications	7

Symptoms.

As a rule, in acute ulcer the symptomatology will be found fairly characteristic, though occasionally no evidence of the presence of the lesion will be afforded until alarming hæmorrhage or perforation, with peritonitis, has taken place.

Generally there will be a very marked history of distinct gastric trouble supervening on anæmia in a young person. The symptoms which are most prominent are pain, vomiting and hæmatemesis. The pain is located in the epigastrium, usually over a small area, but at times tending to radiate in

different directions, mostly toward the left or through to the left subscapular region. It is not in the early stages continuous, though it may become so later; it is originated by the ingestion of food, usually commencing shortly after a meal, and persisting until the stomach has been emptied.

Vomiting is frequent in simple acute ulcer, and often takes place within an hour of taking solid food, which, as a rule, is immediately rejected. Hæmatemesis is also a common symptom, and is much more frequently copious in acute ulceration than in the chronic form.

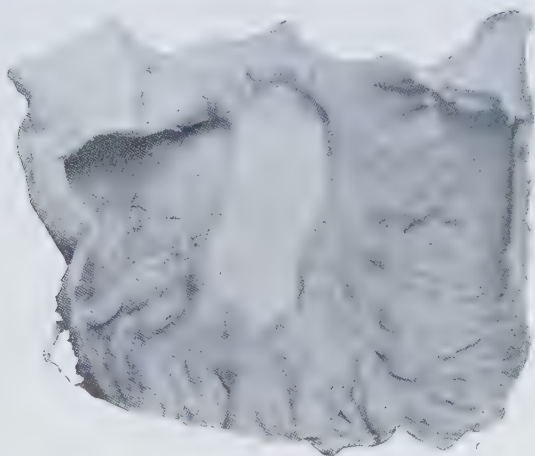


FIG. 32.—LARGE CHRONIC ULCER, $3\frac{1}{2}$ BY $1\frac{1}{4}$ INCHES, ON THE POSTERIOR WALL, ADHERENT TO PANCREAS AND LIVER.
(No. 2,402, Royal College of Surgeons' Museum.)

Chronic ulcer is a disease of middle or advanced age rather than of youth, though I have operated for perforation from chronic ulcer in patients as young as twenty-one years. It is frequently followed by pyloric contraction. If bleeding occurs, it is usually less in quantity than in the cases of the acute ulcer, but the bleeding may be severe, and even fatal.

The characteristic symptoms of gastric ulcer, pain and vomiting, may be absent until some complication supervenes, though usually they are sufficiently distinct. The pain frequently begins from one to two or more hours after food. There is usually tenderness over the pylorus, or between the xiphoid and right costal margin. Vomiting is very irregular,

but when present is characteristic. The vomit is often large in quantity, containing much mucus, and it sometimes consists largely of grumous or coffee-ground-like material; it is often fœtid, and if there be dilatation there will be signs of fermentation, with sarcinæ on microscopic examination. The symptoms vary very much, and may disappear for weeks together. We have observed and operated on cases where the symptoms have been going on for five, seven, fifteen, seventeen and twenty-five years, with more or less long intervals, when the symptoms were in abeyance. Dilatation of the stomach is a frequent complication, and is dependent on pyloric contraction, the result of cicatrization. Loss of flesh is always present; it may be well marked, especially in the later stages, and in some cases is extreme, extending to half the body-weight. A tumour of the pylorus is not infrequently present, and may resemble one due to malignant disease.

Diagnosis.

The well-known symptoms of pain after food and epigastric tenderness, with vomiting and bleeding, as shown by hæmatemesis and melæna, are usually sufficiently characteristic of gastric ulcer; but in some cases hæmatemesis and vomiting may be absent, and only painful indigestion and tenderness may be noticed; or even, in others, all the symptoms may be latent. The surgeon cannot afford to pass over the diagnosis, but must confirm it personally before deciding on the question of surgical treatment.

Doubtless before he sees the case it will have been settled by the physician that the patient is not suffering from simple gastralgia due to anæmia and hyperæsthesia of the stomach, owing to the absence of localized tenderness and of hyperacidity of the gastric juice, as well as from the irregularity of the vomiting and pain, which may occur quite independent of the ingestion of food. He may, however, be called on to negative cancer of the stomach by noting the length of time over which the symptoms may have extended, the absence of a tumour, the presence or increase in quantity of free hydrochloric acid in the vomit, the absence of coffee-ground

vomiting and of cachexia, and the onset of the disease in youth or before middle life, though it must be borne in mind that cancer may occur even in adolescence; and one of us—A. W. M. R.—has performed gastro-enterostomy for cancer of the pylorus in a young woman of twenty-one, the accuracy of the diagnosis being confirmed some months later by an autopsy. The diagnosis between gallstones and ulcer will usually be indicated by the irregularity of the paroxysms of pain, which in gallstone colic occur quite independent of food, by the character and site of the pain, the presence of jaundice and the character of the vomiting, which in cholelithiasis usually comes on soon after the pain begins, and persists long after all food has been rejected.

In the differential diagnosis between ulcer of the duodenum and ulcer of the stomach, the occurrence of the former more frequently in men than in women, and after middle age, the presence of melæna often without hæmatemesis, the pain occurring from an hour to two hours after food, and the tenderness situated to the right of the middle line, will usually afford sufficiently characteristic indications.

We would here point out, as bearing on the site of the ulcer, the importance of the character and site of the pain, which in gastric ulcer is usually definitely localized and associated with tenderness on pressure. The tender area is in the upper abdominal region, the position being more or less to the right or left of the middle line, according to the site of the ulcer. For instance, an ulcer on the anterior surface of the stomach near the cardiac end is usually associated with tenderness between the left costal arch and the mid-line, and relieved by the dorsal decubitus; but if the pylorus be involved, the tender spot will lie between the right costal margin and the middle line, and the pain is relieved by lying on the left side, and aggravated by turning to the right. An ulcer on the posterior wall of the stomach gives rise to less epigastric tenderness, and the pain is felt more in the back beneath the left scapula, or close to the spinal column, opposite the attachment of the ninth, tenth, and eleventh ribs. If adhesions have formed between the pylorus and the liver or gall-bladder, the pain may radiate toward the

right infrascapular region. When the ulcer is on the posterior wall, dorsal decubitus increases the pain, which may be relieved by lying on the face, leaning forward, or even by assuming the erect posture. In all cases of ulcer the pain is usually increased after food, but the time of the onset of pain after eating is significant. Thus, an ulcer close to the cardiac orifice of the stomach causes pain immediately after food has been swallowed, or the pain may even start as the food is being swallowed. On the other hand, in ulcer of the pylorus the pain frequently does not begin until from one to two hours after meals. If the pain is severe, vomiting usually occurs, sometimes immediately after food, at others not for an hour or two, and the act of vomiting usually gives immediate relief. With regard to hæmatemesis, which is said to occur in about 80 per cent. of cases of gastric ulcer, and melæna, which is usually associated with ulcer, but sometimes occurs without hæmatemesis, they will be considered later; for hæmorrhage is one of the important complications on which the opinion of the profession, so far as treatment is concerned, is not yet by any means crystallized.

Latent ulcers are not uncommon; Savariaud gives their proportion as 20 per cent. of all cases of gastric ulcer. It is said that such ulcers are always of the acute round variety, but our experience in three cases, where we had to operate for perforation without any previous symptoms pointing to ulceration, would lead us to form a different opinion; for in both considerable thickening was found around the ulcers, showing that the disease must have existed in a latent form for some considerable time. It is difficult to explain why some of these ulcers should exist without producing symptoms until either perforation or violent hæmorrhage takes place. In the cases we have seen the ulcer has been near the lesser curvature of the stomach, and this might possibly afford an explanation, since in this situation they would be brought less intimately into contact with food.

CHAPTER VIII

GASTRIC ULCER AND ITS COMPLICATIONS

THE complications of gastric ulcer are no less numerous than serious, and before describing each separately, and giving the appropriate treatment, it will be well to mention them collectively. They are as follows :

1. Local peritonitis, or perigastritis, ending in adhesions.
2. Local peritonitis, ending in suppuration and a localized abscess.
3. Subphrenic abscess.
4. Abscess of liver, pancreas, or spleen.
5. Fistula between the stomach or pylorus and adjoining organs, or even with the surface of the body.
6. Acute perforation of the stomach wall.
7. General peritonitis.
8. Hæmatemesis and melæna.
9. Dilatation of the stomach.
10. Tumour of stomach or pylorus.
11. Cicatricial stenosis of pylorus.
12. Hour-glass stomach.
13. Spasm of pylorus producing intermittent narrowing (Reichmann's disease).
14. Atonic motor deficiency.
15. Severe gastralgia.
16. Persistent vomiting.
17. Tetany.
18. Acute or chronic pancreatitis.
19. Profound anæmia resembling the pernicious form.
20. Pressure on, or stricture of, the bile-ducts with jaundice.

21. Catarrh of gall-bladder from adhesions producing attacks like those of cholelithiasis.

22. Great loss of flesh and strength, ending in phthisis.

23. Cancer secondary to ulcer—'ulcus carcinomatosum.'

The treatment of gastric ulcer is at first essentially medical, and when properly carried out, and for a sufficient length of time, it is usually completely successful. Leube says that one-half or three-fourths of all cases will be cured by four or five weeks of treatment, but that if not cured in that time they will not be cured by medical treatment alone. Unfortunately, however, in many cases treatment is stopped as soon as relief to pain is obtained, and long before the ulcer is healed. In some cases this may be due to the uncertainty of diagnosis, or from the impatience of the patient; perhaps in others to ignorance as to how long it takes to secure the healing of the gastric ulcer. The earlier in the course of the disease that radical treatment in the shape of dieting and rest is adopted, the less prolonged will the treatment need to be, and the more likely is it to be effectual; but probably the very earliest time a patient should be allowed to be out of bed is from a fortnight to a month after all pain and tenderness have disappeared. Failing this thorough treatment, relapses will be certain to occur, and in the long-run complications will supervene or the ulcer will become chronic, when, though medical treatment may relieve in some cases, cure can only be looked for in the greater number by surgical methods.

In considering the treatment of ulcer of the stomach, it is useful to hold in view the course of an ulcer of the leg, which directly the healing stage has arrived becomes free from pain. But this neither indicates that healing is completed nor that care may cease, and should treatment be abandoned and the ulcer become chronic, though it may even be painless, it is at any time liable to become inflamed or to extend; moreover, the surrounding tissues become infiltrated with lymph, and contraction occurs, which in a hollow viscus would soon end in stricture, as in the leg it tends to drag on the surrounding skin and produce constriction of the limb.

The medical treatment of ulcer of the stomach consists chiefly in systematic dieting and rest.

The following method of treatment, which is employed by Dr. Robert Saundby (*British Medical Journal*, January 20, 1900, p. 122), is one that should be efficient in ordinary cases; but in severe cases it may be necessary to keep the stomach void of food for several days and to feed by enemata; and then absolute rest in bed may be required over a greater length of time, and abstention from solids will have to be further delayed.

‘It is a rule to which attention may well be called, that, in the management of stomach disorders, obstinate vomiting should be treated by absolute rest in bed, and the administration of the simplest food in small quantities at regular intervals. I generally prescribe an ounce of milk and lime-water every hour, with the following mixture :

Sulphate of magnesium	...	...	40 grains
Sulphate of iron	...	...	2 „
Diluted sulphuric acid	...	...	15 minims
Peppermint-water	...	to	1 ounce

three times a day. The milk and lime-water, if borne without pain and vomiting, as is almost invariably the case, is increased every day or every second day up to 4 ounces every hour, and afterwards the diet is gradually increased by the addition of bread-and-milk, minced chicken, and minced mutton at intervals, so that, about twenty-one days after admission, the patient is usually able to eat the ordinary house-diet of the hospital. After this has been taken for two or three days the patient is allowed to get up, and at the end of a month is sent to a convalescent home. When the anæmia is marked the mixture may be supplemented by pil. ferri, 5 grains or more, three times a day. Should the patient not be able to tolerate so much milk and lime-water in the first instance, $\frac{1}{2}$ ounce may be given, or, if there be only pain without vomiting, a mixture of bismuth and soda may be substituted for that of iron and magnesia.

In those cases which have recently suffered from hæmatemesis, it is desirable to give nothing by the mouth until forty-eight hours have elapsed after the vomiting of blood has stopped, and during that time I feed them by the following nutrient enema, given every four hours: One egg beaten

up with one teaspoonful of brandy, and made up to 4 ounces with milk. Should there be any irritability of the rectum, 20 to 30 drops of laudanum may be added. While the hæmatemesis persists, I place an ice-bag upon the epigastrium, although I am by no means certain that it does any good, and I allow the patient to suck small pieces of ice if she wishes. If necessary, to relieve pain or to keep the patient quiet, I order a hypodermic injection of $\frac{1}{6}$ to $\frac{1}{3}$ grain of morphine. It is of great importance to see that the patient is able to eat ordinary food with comfort before she leaves the hospital, and I always try to impress upon each one the importance of continuing to do this after she returns home. Many of these patients have been dieting themselves for so long a time, and have become convinced partly as the result of injudicious advice, partly from their own experience, that they cannot eat the same food as other people, that they have suffered in health from an insufficient nutrition, and have entered a vicious circle in which the anæmia is kept up by want of food, so that the predisposing cause persists, and recovery is impossible until the circle is broken; it is therefore of the utmost importance to prove to your patient that she can take ordinary food. It is also very desirable that she should continue to take iron for some time after leaving the hospital, and I may perhaps be allowed to mention that the dose of sulphate of magnesium in the mixture should be adjusted to the needs of each case, and may be very properly increased or diminished at different times as required.'

The surgical treatment of intractable or relapsing gastric ulcer is, in the greater number of cases, the only satisfactory method of dealing with these refractory cases, and operation should be resorted to at a much earlier period than has hitherto been the custom, and always before the patient is so far reduced by pain and starvation or the supervention of serious complications that weakness and anæmia render any operative procedure hazardous.

Ulcer of the stomach is a much more serious matter than is generally recognised, for, according to various authors, it has a mortality, when treated by general and medical means only, of from 20 to 50 per cent., and the excuses of a few

years ago, that there is a great responsibility in recommending surgical treatment, either from the uncertainties of diagnosis or from the risk of operation, can no longer avail, since the diagnosis of gastric ulcer, thanks to the researches of Ewald, Hemmeter, Einhorn, and others, has been brought to a greater state of perfection than exists in many other obscure diseases where radical treatment has to be adopted on much more slender foundations; and, fortunately, now that the mortality in operations for simple diseases of the stomach has been reduced in the hands of experienced surgeons to 5, or almost 5, per cent., the risk of surgical treatment cannot be advanced even by the most ardent opponents.

In England we are not prepared to subscribe fully to the views of Tricomi (*Riforma Medica*, 1899), who draws a parallel between the treatment of hernia and that of ordinary gastric ulcer, and proposes that as hernia is treated radically with success, so gastric ulcer should be treated radically by the performance of gastro-enterostomy.

Heydenreich (*Sem. Méd.*, February 2, 1898) argues: 'The death-rate from all cases of gastric ulcer is from 25 to 30 per cent., but from gastro-enterostomy only 16·2 per cent.; therefore the operation has less danger than the disease. Another advantage of not waiting for complications is that the patient is in better health. At any rate, cases which do not improve with medical treatment in a reasonable time should be treated surgically. The question of medical *versus* surgical treatment in this class of cases is one that can be much simplified by a careful study of statistics.'

At the time Mayo Robson delivered the Hunterian Lectures in March, 1900, he had been able to collect 184 operations for gastric ulcer (excluding those for perforation and hæmorrhage), of which 157 recovered and 31 died, thus giving a mortality of 16·4 per cent. These included 34 personal cases, which will be referred to later.

Now, although the deaths from gastric ulcer, medically treated, averaged 25 per cent., and those from even the worst and most inveterate cases of ulcer, when treated

surgically, only 16 per cent. at the time of those lectures, yet the difference did not then appear so great as to make it desirable or prudent very strongly to advocate surgical treatment until the disease had become chronic or until serious complications had ensued.

To-day, however, the facts are very materially altered by the all-round improvement in operations on the stomach, and the contrast of 25 per cent. of deaths in cases treated medically and 5 per cent. as shown in our latest statistics in those treated surgically in the worst and most complicated cases is so striking that we feel it incumbent to urge most strongly that, although cases of gastric ulcer should first be submitted to medical treatment, yet if such treatment fails to cure in a reasonable time, or if relapses occur on the resumption of solid food, then medical should give place to surgical treatment: for it is unfair to the surgeon to hand over to him almost moribund cases, and it is unjust to the patients to persist in dosing them with medicine or otherwise treating palliatively cases that can only be benefited or cured by surgical means.

Operative Treatment.—Before the abdomen is opened it is quite impossible to say what operation or operations will be required, and the surgeon must be prepared to adapt himself to circumstances on discovering the position of the ulcer and the conditions associated with it, especially as to the presence or absence of adhesions and other complications.

Any one of the following operations, or a combination of one or more, may be called for in each individual case: Exploratory gastrotomy; gastro-enterostomy, to secure physiological rest to the stomach and relieve the hyperchlorhydria, or, in other cases, to short-circuit a stenosis; excision of the ulcer; pylorectomy; pyloroplasty; gastroplasty; gastro-gastrostomy; gastrolisis; pylorodiosis; gastrotroplication.

History.—The first operation for the cure of ulcer of the stomach was performed in 1881 by Rydygier, who successfully resected a large ulcer from the posterior wall of the stomach.

A report in the *Centralblatt f. Chir.*, No. 32, 1900, states

that a woman from whom he excised the pylorus in 1881, for chronic ulcer, is now aged forty-two and quite well, and that she has since borne five children. A similar case was treated in 1881 by Van Kleeft. A year later—in 1882—Czerny repeated the operation successfully.

After other cases of excision, Doyen in 1893 introduced the operation of gastro-enterostomy for the treatment of gastric ulcer, and at the German Congress in 1895 he related a series of cases in which he attributed the relief or cure of ulcer of the stomach by gastro-enterostomy to the rest induced by the operation.

Czerny, Monod, Durivier, Kuster, Novaro, Tricomi, ourselves, and many others, have followed on the same lines.

The Preparation of the Patient.—It has been the custom with many surgeons to put stomach patients through a long course of preliminary treatment, such as frequent lavage of the stomach and abstention from food before operation. This, as a rule, is quite unnecessary, and certainly inadvisable in the greater number of cases—first, because the treatment is depressing and debilitating in the case of patients already exhausted by a long illness; secondly, as proved by Dr. Harvey Cushing's bacteriological investigations, the stomach contents speedily become aseptic if the mouth be cleansed and aseptic foods administered; and, thirdly, as proved by ample clinical experience, elaborate preliminary treatment is unnecessary to success.

If the stomach is greatly dilated and the contents are foul, then lavage with simple boiled water night and morning is adopted for two days before operation. The careful cleansing of the mouth and teeth and the administration of foods sterilized by boiling is advisable. The last meal is given the night before, about twelve hours; the stomach is washed out about two hours, and a nutrient enema given about an hour before operation.

In other cases no lavage is adopted, but the same care is exercised in cleansing the mouth, giving sterilized food, and administering a nutrient enema consisting of 1 ounce of brandy, 1 ounce of liquid peptonoids, and 10 ounces of normal saline solution. Every patient is enveloped in a

suit of cotton-wool made by the nurse out of Gamgee tissue, and each has an injection of 10 minims of liq. strychniæ (B.P.) administered subcutaneously before the operation is begun.

The preparation of the skin and other aseptic details of the operation differ in no respect from those observed in operations generally.

Exploratory Gastrotomy, or opening the stomach by a free incision in its anterior wall, is an operation occasionally called for in the surgical treatment of ulcer :

(a) In order to verify the diagnosis of ulcer when there is so much thickening of the stomach walls as to suggest the presence of cancer.

(b) When, although the symptoms have pointed to ulcer as the cause of the gastric trouble, the stomach, on exposure, betrays no evidence of puckering or other characteristic signs, and, in order to verify the diagnosis and ascertain what is best to be done, it is felt desirable to examine the interior of the organ.

(c) In certain cases of gastrorrhagia it is desirable to perform exploratory gastrotomy, in order to find and ligature the bleeding vessels, or to otherwise arrest the hæmorrhage.

(d) It necessarily forms part of any operation for the excision of ulcer of the stomach. The detailed description of the operation is given under the chapter on Gastrorrhagia and its Treatment, p. 130.

It will be gathered, on reading the context, that, as our experience increases, the tendency is to the performance of gastro-enterostomy, without previous exploratory gastrotomy, in cases of ulcer.

As examples of exploratory gastrotomy, we may briefly refer to the following cases :

Man aged thirty-eight. Symptoms of chronic ulcer extending over several years. On exposure of stomach, no evidence on the surface to indicate accuracy of diagnosis. Exploratory gastrotomy. Discovery of large ulcer, $1\frac{1}{2}$ inches by 3 inches, on posterior wall of stomach. Posterior gastro-enterostomy. Recovery.

Acute gastrorrhagia. No evidence of ulcer on exposing the stomach. Exploratory gastrotomy. Numerous bleeding ulcers seen. Two, which were bleeding freely, were ligatured *en masse*. Gastro-enterostomy. Recovery.

Excision of the Ulcer is, as a rule, unnecessary, but not always to be avoided, as in some cases of bleeding ulcer, and in others where the thickening and induration render it difficult to decide on the absence of malignant disease. This was the case in a man of fifty-four on whom Mayo Robson operated in 1891, when, finding the pylorus the seat of diffuse induration, excision of the whole indurated area was performed successfully. A careful examination of the removed mass showed that the growth was inflammatory around a chronic ulcer. In another middle-aged man, where the diffuse induration was suggestive of cancer, the pylorus was opened, and a deep ulcer on the posterior wall successfully excised, the edges of the original incision, as well as the margins of the posterior wound, being brought together in a direction transverse to the axis of the pylorus over a bone bobbin, as in the modified operation of gastro-enterostomy.

Rydygier prefers excision of the ulcer to gastro-enterostomy, because he believes that carcinoma not infrequently develops in the scar of an old ulcer.

It is impracticable to give any specific description of the operation of excision of an ulcer other than will be given in the description of operations involving the removal of part of the stomach wall, seeing that the procedure will vary with the size and position of the ulcer.

The cases related below sufficiently exemplify the operations that may be necessary.

After excision of an ulcer, the bleeding from large vessels must be controlled by ligature, but the oozing from the smaller vessels will be stopped readily by the continuous suture employed to bring together the edges of the wound. If the excision involve the serous coat, a Lembert's continuous stitch, with a silk or celluloid thread suture, will be necessary. Should the excision have been near the pylorus, the line of suture must be placed transversely to the axis of the canal, so as to avoid stricture.

The following cases are examples of gastric ulcers treated by excision :

ULCER OF PYLORUS ; STENOSIS ; DILATATION OF STOMACH.
EXCISION OF ULCER AND PYLOROPLASTY.

John W. R., aged thirty-eight, admitted to the Leeds Infirmary with the history of stomach trouble for thirteen years. Pain after food and vomiting were the initial symptoms. Severe hæmatemesis occurred six years after the onset of symptoms. Great loss of flesh and weakness were followed by inability to work, although he had stomach lavage and other appropriate treatment. On admission, the patient was very thin and profoundly weak. He weighed 8 stones. An indefinite swelling could be felt below the right costal margin. The stomach reached 3 inches below the umbilicus, and there was visible peristalsis. Free HCl present. Operation November 15, 1900. The pylorus was found much thickened, forming a hard nodular swelling, adherent to the gall-bladder and liver, and to the abdominal wall by omental adhesions. After separating the adhesions, a small perforation was discovered in front of the pylorus, evidently the site of a perforation which his medical man, who was present, said he remembered occurring some months previously, and which was then treated successfully by rest and rectal feeding.

The pylorus was freely laid open, and found to be the site of a round perforating ulcer in front, and another in the posterior wall ; the latter had perforated into the substance of the pancreas. Both were resected, the removal thus practically constituting a pylorotomy. The edges of the posterior wound were brought together transversely to the axis of the stomach. The anterior wound was prolonged into the duodenum, and its edges were brought together, also transversely to the axis of the stomach, over a bone bobbin, thus leaving a capacious channel between the stomach and duodenum surrounded by healthy mucous membrane.

Recovery was uninterrupted, and he was discharged on December 12, weighing 8 stones 5 pounds.

On January 9, 1901, he returned to report himself well, and then weighed 9 stones 11 pounds.

PYLORIC ULCER TREATED BY EXCISION OF ULCER AND
PYLOROPLASTY.

Mrs. M. K., aged forty-four. Seen by Mayo Robson, with Dr. Johnstone, Ilkley. Well till two years ago, when she had

colic and loss of flesh. Under treatment she recovered, apparently, and regained some of the lost weight.

September 15, 1897.—Recurrence of attacks similar to that of a year before, but with pain at the right side over the pylorus. Loss of weight and strength. The patient had for some time been an invalid, and had been continuously under medical treatment for months. Her weight was 6 stones 11 pounds. There was visible peristalsis toward the pylorus, which was fixed to the gall-bladder; no pain or tenderness. Liver 2 inches below costal margin, but not nodular, and no jaundice present.

July 23, 1898.—Operation. An ulcer at the pylorus adherent to the liver, which formed the base of the ulcer; stenosis of pylorus. Pyloroplasty performed after excision of ulcer, the opening being sutured transversely over a bone bobbin.

December 3, 1898.—Had gained 1 stone 8 pounds in weight. No trouble in digesting anything.

December 23, 1899.—Dr. Hearder reports patient as 'very well,' and of normal weight.

The operation of **Pylorectomy** for ulceration of the pylorus may be mentioned under the heading of excision of ulcer, though it will be more convenient to consider this operation in detail when describing partial gastrectomy for cancer, seeing that the operation for the two conditions is essentially the same. Dr. Rodman (*Philadelphia Medical Journal*, June 9, 1900) has collected from literature and personal correspondence detailed reports of forty pylorectomies, partial gastrectomies and excisions, with six deaths. As this includes cases since 1881, when Rydygier performed the first excision of ulcer, it does not show the operation under a favourable light, the mortality being 15 per cent.; for it would be found that the later operations under improved technique contrast favourably with the earlier ones. One of us—Mayo Robson—has performed the operation of excision of gastric ulcer six times, all the patients recovering.

Nevertheless, the mortality after excision will probably always be higher than the more simple operation of gastro-enterostomy, with its 5 per cent. or smaller mortality. The more severe and radical operation should therefore be reserved for cases that are not suitable for the less severe operation, or for cases in which the suspicion of cancerous degeneration

is entertained, and cannot be disproved on naked-eye inspection.

The following case is an example :

TUMOUR OF PYLORUS AND CHRONIC HÆMATEMESIS DUE TO
ULCER. PYLORECTOMY.

In 1891 one of us (A. W. M. R.) was asked by a medical friend to see a man of fifty-four, who for six months had suffered from pain coming on an hour after food, and more recently from vomiting of blood of coffee-ground character in considerable quantities, so that he was not only reduced in flesh and strength, but had also been rendered profoundly anæmic by the loss of blood.

A tumour of the pylorus could be easily felt, and the stomach was markedly dilated.

As he was rapidly losing ground, an operation was performed, and the pylorus found thickened and nodular, with adhesions to the liver and omentum. After separating the adhesions, the pylorus was excised, and the open end of the duodenum was fixed to the opening in the stomach by means of two lines of sutures without the use of a bobbin, the rest of the stomach aperture being closed by a double layer of sutures.

The tumour proved to be inflammatory around an open ulcer which had been the source of the hæmorrhage. The bleeding was not repeated, and the patient rapidly gained flesh, and returned home within the month.

The subsequent history of this case is interesting on account of cicatricial contraction of the new pyloric aperture, which led to the invention and employment of a decalcified bone bobbin to act as a temporary splint upon which to apply the sutures, and so secure a large aperture which has little tendency to contract.

Gastro-enterostomy, in the absence of special complications, is the operation to be relied on in the treatment of ulcer of the stomach ; it acts by securing physiological rest by means of drainage, thus allowing the ulcer to heal without being subjected to the irritation of acid secretion, accumulation of food, or frequent stomach movement. It also, while remedying the hyperchlorhydria, relieves pyloric spasm, and while preventing stagnation of fluids, cures or materially diminishes gastric dilatation. The posterior operation is the one we personally prefer, the junction of the posterior wall of the

stomach with the first part of the jejunum being effected by two continuous sutures with or without a decalcified bone bobbin. The use of a bone bobbin not only secures a temporary protection to the line of incision, but secures an ample and immediately patent opening between the two viscera for the passage of the stomach contents. The whole operation can be easily completed in half an hour, and it may even be done in half the time.

Our experience with the posterior operation has been very favourable, not only in the rate of recovery of the patients, but in the smoothness of the recovery, many of the patients recovering without even once vomiting; and only on two occasions have we seen slight regurgitant vomiting of bile, which in the anterior operation is much more frequently seen, and at times becomes serious, or even leads to a fatal issue.

We have performed the operation on forty patients with two deaths, or an average mortality of 5 per cent.; but as the deaths were from more or less accidental causes, which should be avoided in the future, and occurred respectively on the tenth and eleventh days after operation, during the whole of which time the patients had been able to take and assimilate food, the gastro-enterostomy *per se* cannot be blamed for the fatal result, which might under similar circumstances have occurred after any operation. Under the description of the operation of gastro-enterostomy will be found a brief résumé of all the cases on which we have operated.

A detailed description of the operation of gastro-enterostomy and its modifications will be found on p. 268.

Dr. Fantino (*Archiv. für Klinische Chirurgie*, Bd. xlv., 1 and 2) examined Professor Carle's cases of gastro-enterostomy as regards the following points:

1. Changes in the peristalsis of the stomach.
2. The ability or non-ability of the new sphincters to close the outlet.
3. The capacity of the stomach.
4. The secretion of hydrochloric acid.

In the cases examined, the operation immediately improved the peristaltic power of the stomach, though it did not render

it normal. The stomach could generally empty itself, but did so gradually. Systematic examinations of the stomach contents were made after test-meals, etc., and showed that after an irregular period the stomach regained completely its power of emptying itself; in fact, as a rule, after gastro-enterostomy the stomach would be found practically empty in three to five hours after a meal.

Generally it was found that the stomach decreased in size soon after gastro-enterostomy, so that the formerly distended organ became normal in size. Examination of the stomach by means of distension with carbonic acid and by other methods showed that a sphincter was developed at the new opening, and that its power increased with time. The secretion of hydrochloric acid after operation was studied. In cases where there was formerly hyperacidity this condition was lost, and though the degree of acidity in an individual case varied from time to time, yet these variations did not depart from physiological limits. In the same examinations it was found that regurgitation of bile into the stomach took place, but it was of no importance so long as the outlet from the organ was sufficient. Cases of hypo- and anacidity showed no change in their gastric juice after operation, showing clearly that this condition is not dependent on obstruction, but on previous changes in the mucous membranes, these changes being probably in the nature of an atrophy of the peptogastric glands.

The following cases are given as examples :

CASE I.—Mrs. W., aged thirty-two. Pyloric ulcer treated by pyloroplasty, with subsequent contraction. Gastro-enterostomy (anterior). Seen by A. W. M. R., with Dr. Salter of Scarborough. Pyloroplasty during active ulceration of pylorus in December, 1895. Great relief for a time, but later recurrence of dilatation, vomiting, pain, and other symptoms. Very considerable loss of flesh. Patient thin and anæmic; pulse feeble and rapid, marked dilatation, the stomach reaching well below the umbilicus.

October 4, 1898.—Operation: gastro-enterostomy (bone bobbin employed).

In October, 1899, patient well and active.

February, 1900, had gained 1 stone 10 pounds.

CASE 2.—Mr. M. A., aged twenty-eight. Pyloric ulcer, tumour of pylorus. Gastro-enterostomy (anterior). Seen by A. W. M. R., with Dr. Kilner Clarke of Huddersfield. Loss of weight. Two years ago was 12 stones 12 pounds; now 9 stones 6 pounds. Pain two hours after food. For last two months vomiting on an average five times a week—twice coffee-grounds. Enormous dilatation of stomach. Pyloric tumour movable; visible peristalsis.

August 4, 1899.—Operation. Large mass at pylorus, evidently thickening, due to active ulceration; glands large, but not matted. Gastro-enterostomy (bone bobbin used).

August 27, 1899.—Good recovery. Weighs 9 stones 7 pounds.

September 20, 1899.—Weighs 10 stones 13 pounds. Can eat anything.

Well 1901.

CASE 3.—Mr. D. B., aged thirty-one. Extensive ulceration of stomach, with large tumour. Gastro-enterostomy (anterior). Seen by A. W. M. R., with Dr. Barrs and Dr. Webster, Golcar. Dyspepsia seventeen years; more severe last twenty months. Lead-poisoning discovered and treated. Good recovery. Sixteen months ago vomiting recurred, and from outset large quantities ejected, but never containing blood. Recurrence occasionally of similar attacks, always relieved by treatment.

December, 1897.—Stomach reached pubes, and visible peristalsis seen. Relief followed dieting and lavage till March, 1898, since which time pain almost constant. Pain not materially worse after food nor relieved by vomiting. Loss of weight from 10 stones to 8 stones 6½ pounds. Great feebleness.

May 6, 1898.—Operation. Large irregular tumour at pylorus and along lesser curvature; but glands, though large, discrete. Gastro-enterostomy (bone bobbin employed).

June 7, 1898.—8 stones in weight when he left the home.

August 17, 1898.—Weighs 9 stones 3 pounds.

Letter dated February 12, 1900: 'My health continues perfect. I have not lost a day's work through illness since I recovered.'

Examples of posterior gastro-enterostomy:

CASE 4.—Miss H., thirty-two, sent to Mayo Robson by Dr. Angus of Bingley with a history of stomach symptoms extending over several years. She had had hæmatemesis in 1892 and 1896, since which time she had suffered from flatulency and pain after food. For two years epigastric pain constant, but increased by food. A year after vomited daily, then relief for a time; but for some months only milk could be retained.

Epigastric tenderness was well marked, and in distending the

stomach with CO₂ it reached $\frac{1}{2}$ inch below the umbilicus and far over to the right of the middle line.

October 5, 1900.—Posterior gastro-enterostomy performed, a bone bobbin being employed.

Recovery uninterrupted. Returned home within the month, taking solid food without any discomfort and gaining flesh.

On November 8 Dr. Angus wrote: 'I have seen Miss H. since her return, and there is every reason to be pleased with her condition. She has lost all her pain and is taking food well. Allow me to thank you for her restoration to comparative health.'

Weight February, 1901, 8 stones 6 pounds; at time of operation, 6 stones 12 pounds.

CASE 5.—Mr. H., aged fifty-two, sent to Mayo Robson by Dr. Hearder of Ilkley, began to suffer in 1897 from symptoms of ulcer of stomach, which were relieved by restricted diet and general treatment; but in July, 1899, the symptoms returned, with loss of flesh, and well-marked dilatation of the stomach was discovered, and operative treatment advised.

Lavage and other treatment was carried out in London and in Scotland, but without material improvement.

When first seen by us there was visible peristalsis, with well-marked stomach splash and a tender spot under the right costal margin. Although tall, the patient only weighed 8 stones 6 pounds, and he was extremely weak and pallid. Free HCl was discovered in the stomach contents.

October 12, 1900.—Hour-glass contraction found, but the constriction was not extreme. Puckering on anterior wall of stomach, with well-marked thickening. Posterior gastro-enterostomy performed. Good recovery.

March 4, 1901.—Patient wrote from Bournemouth saying: 'I am pleased to be able to tell you that I have no return of my former complaint, and that I eat, drink, and sleep well. Have got back to my former weight.'

CASE 6.—*History.*—J. S., aged forty-five, residing at Batley, gave the history of two years' pain about an hour after food, with great loss of flesh. For nine months he had vomited every day, or every second day, a large quantity of yeasty material, but no blood, though he was very anæmic.

There were well-marked signs of dilatation, with tenderness over the pylorus.

June 12, 1900.—Operation. On opening the abdomen the pylorus was much thickened and adherent, forming a tumour, and through the centre of the mass a No. 10 catheter could only be passed over a roughened, ulcerated surface. A posterior gastro-enterostomy was performed.

After-history.—An uninterrupted recovery followed. Food was begun the second day, and solids could be taken in the second week without pain. He rapidly gained flesh and strength, and is now well.

Demoulin and Tuffier (*Bull. et Mém. de la Soc. de Chir. de Paris*, October 31, 1899, and *British Medical Journal*, Suppl., 1899) publish the case of a naval Lieutenant, aged thirty-two, who suffered from severe dyspeptic symptoms early in 1897, aggravated by a diet of preserved meat during a cruise round the coast of Ireland. Early in 1898 a hard swelling developed in the epigastrium. Medical treatment at Vichy and elsewhere was of no avail. His weight fell to 77 pounds, the cachexia was marked, and emaciation extreme. The swelling was as big as an orange, movable transversely, and following respiratory movements. It was tough rather than hard. Directly the patient swallowed anything, even a few spoonfuls of water, great distension of the epigastrium, with severe pain, occurred, due evidently to contraction of the stomach for forcing its contents through the pylorus. Malignant tumour was diagnosed, and Demoulin operated on December 1, 1899. An incision 4 inches long was made in the middle line above the umbilicus. A soft tumour of the size of an orange lay around the pylorus and adjacent parts of the stomach and duodenum. It felt like a fatty growth, and was not adherent to any surrounding structures. A stellate cicatrix on its upper aspect showed signs of a healing ulcer. There were no enlarged glands in the neighbouring peritoneal folds; the liver and gall-bladder were healthy. The patient was in so exhausted a condition that a pylorectomy was considered impracticable. Demoulin therefore performed a Van Hacker's gastro-enterostomy (posterior and transmesolic), leaving the tumour alone. A litre of salt solution was injected under the skin directly after the operation. The patient's life was in great peril for several days from ether bronchitis. On the third day hæmatemesis occurred, and nearly a pint of blood was vomited. By the 10th the patient was able to eat fish and fowl without any bad effects. On the 20th Demoulin for the first time palpated the epigastrium. To his surprise, the tumour could no longer be felt, its site being marked by a little thickening, which vanished within ten days. In May the patient was again on active naval service; no local symptoms remained, but he was troubled with an obstinate cough and free expectoration.

Bowreman Jessett has recently described a somewhat similar case (*British Medical Journal*, April, 1901).

Pyloroplasty will be more fully described when the subject

of pyloric stenosis is under consideration, but we must not fail to mention it as a method of treatment in certain cases of chronic ulcer associated with stenosis of the pylorus. The operation as a curative measure in this class of cases has certain very definite limitations, but where it is feasible it is a method of great utility, which can be performed rapidly and with very little exposure of viscera. Pyloroplasty, if the pylorus be stenosed, free from extensive adhesions, easily drawn forward, and not actively ulcerating, is a simple and short operation, and in quite a number of cases of both gastric and pyloric ulcer we have found it to answer well. It must not be relied on, however, where active ulceration of the pylorus itself is found, unless at the same time the ulcer be completely excised; otherwise cicatricial contraction will occur, and a second operation will be subsequently required. It acts in the same way as does gastro-enterostomy, by affording a free exit to the stomach contents, and thus securing physiological rest to the stomach.

The following cases exemplify the complete success which attended the operation in appropriate conditions, and also the disappointment which followed its employment in one of the earlier cases, which, owing to inexperience, was not properly selected.

Professors Carle and Fantino (*loc. cit.*) compare the operations of gastro-enterostomy and pyloroplasty. Out of fourteen cases in which the latter operation was performed, only one died. The results of pyloroplasty, as regards function, have been little noticed in literature. To the authors' fourteen cases, three may be added where the operation was by tearing, but the results were the same. In all the seventeen cases the results were excellent—in thirteen of them perfect and permanent, as it is now from three to seven years since operation. In these the condition of the secretions and of the peristaltic power of the stomach were the same as after gastro-enterostomy for non-malignant stenosis. Diminution in size of the stomach was not so marked as would be expected in the presence of such remarkable recovery of the general health and of the stomach's power to empty itself. In

all cases, with one exception, the gastric capacity was more or less diminished, but in no case did it become normal in size.

A few cases must be excepted where operation was performed for hyperacidity, with gastric atony. In these, four to five months after operation, there was delayed evacuation of the stomach and a feeling of weight. Although the general improvement was considerable, yet the authors were persuaded that a posterior gastro-enterostomy would have given better results. In one of the cases a subsequent gastro-enterostomy gave a perfect recovery.

In cases where there was hyperacidity before the operation, there was a rapid return to the normal, *but not to below* normal, as we found after gastro-enterostomy. The authors believe that the rapid and great diminution in hydrochloric acid after the latter operation is due to the very rapid evacuation of the stomach after a meal, and do not deny the possible influence of a regurgitation of bile into the stomach. Both these conditions are absent after pyloroplasty; hence the difference in secretion.

In cases of hypo- and anacidity, operation produced no change in this particular, and yet health was restored. The results of pyloroplasty may be summarized:

1. Regurgitation of bile into the stomach is prevented.
2. Secretion of hydrochloric acid, when it has been excessive, becomes normal.
3. If the secretion of hydrochloric acid has been diminished or absent before operation, it remains *in statu quo* after operation.
4. If there has been primary gastric atony, peristalsis is but little improved.
5. This function improves rapidly or reaches perfection if the muscular contractility has been normal or increased, and when the obstruction was due to fibrous stenosis or pyloric spasm.
6. In all such cases evacuation of the stomach is accomplished in its physiological period. Only in rare cases, and these only in the first months after operation, may it be delayed.

7. The capacity of the stomach always decreases, but rarely becomes as small as normal.

8. The pylorus recovers tone.

Points of difference between the results of pyloroplasty and gastro-enterostomy are :

1. The absence of regurgitation of bile, and hence the absence of any possible biliary influence on the gastric secretions.

2. The evacuation of the stomach is not accelerated ; hence the difficulty the stomach has in reaching its normal size.

3. The slight or negative result obtained by pyloroplasty in obstruction from primary gastric atony compared to the positive results from posterior gastro-enterostomy.

Pyloroplasty is too dangerous in cases where there are extensive, severe hardening of the tissues, much peripyloritis, and adhesions to liver, gall-bladder, colon, etc., and in cases of duodenal stenosis. It is indicated in cases of spasmodic stenosis, and in slight annular stenoses from ulceration accompanied by muscular hypertrophy.

Statistics.—In the Hunterian Lectures we collected 318 cases of pyloroplasty from all sources, of which 269 recovered, which equals a mortality of 15·4 per cent. This included 14 cases of Mayo Robson's, of which 12 recovered—a mortality of 14·2 per cent. As in the earlier operations many were performed on cases that would be now treated by gastro-enterostomy, the mortality in properly-selected cases, we think, should not exceed 5 per cent. at the outside estimate, and of the 12 cases operated on by Mayo Robson since 1897 there is no fatality to record.

CASE I.—*March 9, 1895.*—Mrs. W., aged twenty-nine. Seen by Mayo Robson with Dr. S. 'Spasms' for ten years, but pain more on left side. Attacks two or three times a week ; start without apparent reason, last an hour or two, but may persist twenty-four hours, relieved by vomiting. Severe cramp in legs, loss of 2 stones in weight, no jaundice, marked constipation. Rigid right rectus ; no rigidity, but tenderness to left. Dilatation of stomach well marked.

November 22, 1895.—Relief under treatment, followed by re-

lapse; now vomiting daily. Weight 9 stones. Operation. Adhesions of pylorus separated. Active ulceration at pylorus and tight stricture. Pyloroplasty (bone bobbin).

July 24, 1897.—Weight 9 stones 5 pounds, very much better. Relapse in 1898, possibly from recurrence of ulceration. We then performed gastro-enterostomy. Quite well in 1900, and former weight fully regained.

CASE 2.—*January 13, 1897.*—Mr. M. B., aged fifty-two. Ulcer of pylorus, with stricture. Pyloroplasty. Seen by Mayo Robson with Dr. Wilks, Grassington. Bad health for twenty years, with dyspepsia. Enteric fever nine years ago. Last two years much worse—pain, sickness, and vomiting two to three hours after meals, relieved by vomiting of large amounts. Never vomited blood. Loss of flesh. Weight 9 stones 3 pounds. Emaciation, dilatation of stomach. No tumour. Operation. Stricture of pylorus. Pyloroplasty (bone bobbin used).

September 19, 1898.—Dr. Wilks writes: ‘For some time little improvement; stomach now works well. Looks better than I have ever seen him.’ Well February, 1901. Has gained normal weight.

CASE 3.—*March 18, 1897.*—Mrs. W., aged forty-six. Stricture, with active ulceration at pylorus. Pyloroplasty. Seen by Mayo Robson with Dr. Drake, Headingley. Gastralgia for several years, relieved by food. In November, 1894, vomited dark fluid; since then frequent vomiting, longest interval two or three weeks. Pain in stomach, accompanied by hard lump, and often followed by vomiting. Great loss of flesh and strength.

Operation. Pyloroplasty for contraction and thickening of pylorus, passage only admitting a No. 12 catheter. Good recovery. Well 1899. Considerable gain in weight.

CASE 4.—*May 24, 1897.*—Mr. H., aged thirty-nine. Seen by Mayo Robson with Dr. Matheson, Sheffield. Letter dated May 13, 1897, to say: ‘During the last eighteen months I have suffered much pain, which has caused me to be bed-fast for two, three, or four weeks at a time, and it has required another month or more for me to gain strength enough to move about.’ Eighteen months ago epigastric pain several hours after food, relieved by vomiting. Since then health never good; three and a half months ago similar attack, very severe, with collapse. Vomit contained blood. Fourteen days ago another severe attack. Normal weight 10 stones 10 pounds; now 9 stones $3\frac{1}{2}$ pounds. Stomach ‘weak’ since childhood. Marked dilatation. No tumour.

Operation. Deep ulcer at pylorus. Extreme stricture, barely admitting ordinary director. Pyloroplasty (bone bobbin used).

Complete recovery from operation, and rapidly regained normal weight. Letter dated February 16, 1898, to say: 'I thought you would like to know that I am able to attend business as usual, and have done so without interruption since July 19, 1897.'

CASE 5.—*July 12, 1897.*—Mrs. W., aged forty-six. Seen by Mayo Robson with Dr. Johnson, Aysgarth. Said to have had ulcer of stomach twenty years ago. Since then subject to attacks of pain half to two hours after food; sometimes continuous pain. For three or four months vomiting three times a day. Lost a stone weight in that time. Leading life of an invalid, and for a long period under medical treatment without benefit. Dilatation of stomach; visible peristalsis; tenderness over stomach, especially at the pylorus. No tumour could be felt.

Operation. Stomach much dilated; thickening at pylorus. Pyloroplasty (bone bobbin used).

Good recovery. Weighed 11 stones January 8, 1898, a gain of over 2 stones.

CASE 6.—*July 27, 1897.*—Mr. C., aged twenty-three. Seen by Mayo Robson with Dr. Percival and Dr. Barrs. Vomiting and loss of flesh for two years. Was 10 stones; now is 7 stones in weight. Dieting and lavage give only temporary relief. Emaciation, pallor, dilatation of stomach. No tumour.

Operation. Much-contracted pylorus, great hypertrophy, the walls more than $\frac{1}{3}$ inch thick. Pyloroplasty with bone bobbin. Good recovery.

December 23, 1897.—Weight 9 stones 2 pounds. Well.

CASE 7.—W. F., aged fifty-two, was sent to Mayo Robson by Dr. Cheesewright, of Rotherham, in March, 1895. He had suffered from indigestion for two years. This, however, had not interfered much with his general health till the previous Christmas, when the indigestion was accompanied every second day by acute pain and vomiting, coming on about two hours after food. The vomited matter was in large quantity, offensive and sour, and at times coffee-ground in character. From this time the patient became extremely weak and pale, and rapidly lost flesh to the extent of $1\frac{1}{2}$ stones in five weeks. He had no previous history of severe illness nor did his family history denote hereditary tendency to disease. Patient extremely emaciated, anæmic, and weak; tongue coated and bowels constipated. He had pain on pressure over the pylorus, but no distinct tumour was felt. There was marked dilatation of the stomach, and during the attacks of pain it could be felt to harden under the hand. Heart, lungs, and urine normal. Our feeling was that, on account of the very rapid loss of flesh, accompanied by cachexia, the patient was suffering from cancer of the pylorus. Operation was advised

with a view to performing pyloroplasty or pylorotomy, as circumstances demanded, since washing out the stomach and all ordinary medical means had given no relief.

On April 8, 1898, the abdomen was opened by an incision in the middle line above the umbilicus, exposing the pylorus, which formed a distinct tumour adherent to and under cover of the liver, and which, after being freed from adhesion to surrounding structures, was found to be tightly strictured, so as only to admit the passage of a No. 12 catheter, the mucous membrane being extensively ulcerated and the walls thick and almost cartilaginous. The stricture was incised longitudinally and sutured transversely over a bone bobbin by a double row of sutures. The stomach was much dilated, atonic, and anæmic. Though the pyloric tumour gave rise at the moment to a suspicion of cancer, there was no evidence of growth and the glands were not affected. The after-progress of the case was uneventful, the wound healing by first intention. A month later he had gained 7 pounds in weight, and on October 30, 1896, he called to report himself, looking robust and well. He had gained 3 stones in weight since his operation.

Gastroplasty is an operation that we have successfully employed in a number of cases of chronic ulcer of the stomach leading to hour-glass contraction. The operation, which can be performed in several ways, will be fully described in the chapter dealing with that deformity of the stomach.

It consists in making a longitudinal incision through the strictured part of the stomach and bringing the edges of the wound together transversely, thus obliterating the stricture. A convenient method of performing the operation is by the use of a large decalcified bone bobbin, as described in the cases appended to the chapter on hour-glass contraction.

If the strictured part of the stomach be actively ulcerating, as in a case related elsewhere, the ulcer must be excised at the same time—otherwise subsequent contraction may occur; or possibly the ulcer, already chronic, may persist, and lead to a continuance of the symptoms. In such a case, if excision be impracticable, gastro-enterostomy must be performed.

The operation of **Gastro-gastrostomy**, in order to short-circuit the constriction in hour-glass contraction of the stomach due to chronic ulcer, will be described later.

Adhesions of the stomach to adjoining organs are so common in chronic stomach ulceration that **Gastrolysis**, or the detaching or otherwise treating bands and short adhesions to adjoining viscera or to the abdominal wall, is performed in by far the greater number of cases. Such adhesions are frequently the only remnants of ulcers that have healed; at other times they have been left by perforation of the stomach wall by an ulcer, from the dire consequences of which they have saved the patient. In many cases they give rise to symptoms resembling ulcer, though the adhesions may be due to causes such as gall-stones outside the stomach itself. In such cases the operation of gastrolysis may be entirely curative.

We propose to describe the operation under the chapter dealing with Adhesions, but give one case here as an example of the benefits to be derived from the operations of gastrolysis alone.

GASTROLYSIS FOR ADHESIONS CAUSED BY CHRONIC GASTRIC ULCER.

Miss M. B., aged forty-two. Seen by Mayo Robson and Dr. Holmes, of Garstang.

History.—Twenty-two years ago symptoms of ulcer of stomach. Since then has suffered from vomiting attacks every week or two, and from pain after food. During the last three years symptoms more marked. Under medical treatment, with rest in bed, no improvement. Vomited matter large in quantity and fermenting, sometimes containing blood. Loss of weight to the extent of 3 stones. Great tenderness over stomach, especially to the left. Stomach dilated, reaching below umbilicus and well over to the right.

Operation. On anterior surface of stomach scar of an old ulcer. Lesser curvature closely adherent to the liver. Pyloric extremity and first part of duodenum attached to the gall-bladder and cystic duct.

January 2, 1900.—Operation. Adhesions separated and omentum interposed between pylorus and gall-bladder.

March 7, 1900.—Perfect recovery. Can eat anything without discomfort, and is rapidly putting on flesh.

Has gained 20 pounds since her operation in January.

Some months later had gained 2 stones 10 pounds.

Pylorodiosis, by which name is understood the operation of stretching the pyloric sphincter, either by means of the fingers invaginating the stomach wall, when it is known as 'Hahn's operation,' or by digital or instrumental stretching after having made an opening into the stomach, when it is known as 'Loreta's operation,' is a method of little practical value in the treatment of ulcer, and in some of the cases where we performed the operation, though the immediate results were good, relapses occurred.

The operation will be described under Pyloric Stenosis.

CHAPTER IX

THE COMPLICATIONS OF GASTRIC ULCER

Gastrorrhagia

THE opinion held by many practitioners of medicine, 'that bleeding from the stomach the result of ulceration rarely proves fatal,' requires carefully reconsidering, and the facts marshalling and looking at also from the surgical point of view.

Just as in other internal hæmorrhages, bleeding from the stomach was until quite recently a subject that, so far as treatment is concerned, only came under the notice of the physician. It is only since the advances in surgery have demonstrated the feasibility and safety of exploring the abdomen that the question of surgical treatment of hæmatemesis has been a subject that can be discussed with advantage. In this chapter we shall confine our remarks altogether to the most common, and certainly the most important, cause of gastrorrhagia—simple ulcer—leaving out of consideration for the present the vomiting of blood from cirrhosis of the liver, cancer of the stomach, miliary aneurism, aneurism of the aorta and other vessels, purpura, scurvy, heart disease, leukæmia, typhoid fever, and other more obscure conditions only amenable to medical treatment.

When it is borne in mind that gastric ulcer occurs in 5 per cent. of the community, and that, according to Brinton, Habershon, Müller, Dreschfeld, Lebert, and others, the mortality from all causes in all cases of ulcer is from 10 per cent. to 50 per cent., it must be at once allowed that the consideration of the subject is a matter that should claim the attention of the profession to a greater extent than it has hitherto done. Its importance will be better grasped if these figures are

applied to the population of a city like Leeds, which, for convenience' sake, we will take at 500,000. Of this number 25,000 persons may be supposed to have or to have had ulcer of the stomach, and out of these, taking the mean estimate of mortality as 25 per cent.—though this is under the mean as given by the authorities named—6,250, or 12,500 per 1,000,000 of the population, may be expected to die from gastric ulcer or some of its complications. When it is fully grasped that many of the complications can only be dealt with successfully by surgical means, and that even in the mildest cases of gastric ulcer some of the most serious complications, such as perforation and hæmorrhage, may suddenly supervene, we think that all will agree with the opinion that physicians and surgeons should, in the treatment of these serious cases, be in a closer touch and have a more perfect understanding, so that valuable time may be not lost when surgical interference is required. At present we have no hesitation in expressing a conviction that the treatment of gastric ulcer, especially among the working classes, is altogether too careless and unscientific, and that the outpatient treatment of such cases, whether in hospital or private practice, is absolutely wrong and attended with danger, either of sudden catastrophe from rupture or bleeding, or of the transformation of an acute into a chronic disease, which can then only in the greater number of cases be set right by a surgical operation. As soon as gastric ulcer is suspected, the patient should be told the serious nature of the disease, and the uncertainty of cure without rest in bed and long-continued care in diet under proper medical supervision. If, then, from business or other reasons the advice of the medical attendant is ignored, the blame rests on the patient, and not, as at present is so often the case, on the slipshod method of aiming at relief and calling it a cure. Fortunately, the surgical treatment of chronic and recurring gastric ulcer and its complications is becoming more and more advocated, and with increasing experience more and more perfect, so that to-day the tale is very different from that given in the Hunterian Lectures (Mayo Robson) delivered at the Royal College of Surgeons in 1900. One hundred

and eighty-eight cases of operation for chronic gastric ulcer, including thirty-four cases of the lecturer's, but excluding operations for perforation and hæmorrhage, were then collected. Out of these cases thirty-one patients died, giving a mortality of 16·4 per cent.; but recent experience in a largely extended number of cases shows barely a rate of 5 per cent.; and as all the patients were either chronic invalids or ill unto death, that means a saving of life in 95 per cent. of the cases, either by gastro-enterostomy, gastropasty, pyloroplasty, pylorectomy, or gastrolisis.

The complication of hæmorrhage from the stomach, which according to different authorities occurs in a greater or less degree in from 50 to 80 per cent. of all cases of gastric ulcer, is, it is said, fatal when medically treated in from 11 to 3 per cent. (Müller, 11 per cent.; Welch, from 3 to 5 per cent.; Brinton, 5 per cent.; Debove, 5 per cent.; Steiner, 6·36 per cent.; Lebert, 3 per cent.; Dreschfeld, 3½ per cent.; and Rodman, 8 per cent.). If we take the average, 7 per cent. of deaths in cases of gastrorrhagia from ulcer will not be far from the truth. If this is worked out in the 500,000 population of a city like Leeds, it means that, of the 25,000 persons who have or have had ulcer, 12,500 suffer from hæmatemesis, and of these 7 per cent., or 875, die. We are therefore dealing with a very serious and common accident.

The bleeding may be arterial, venous or capillary, and, curiously, capillary hæmorrhage may be so free as to render it difficult to say that some large vessel has not given way; yet after death a careful examination may fail to discover any gross vascular lesion. Although capillary hæmorrhage may supervene on other conditions, such as congested portal circulation, enlargement of the spleen, and engorgement of the venous system, when general treatment will usually be all-sufficient, yet there are two special conditions in which the bleeding may be so free as to raise the question of surgical treatment: these are vicarious hæmatemesis at the menstrual period and post-operative hæmatemesis. The former condition is well recognised, and usually yields to medical treatment. Petersen's experience of surgical treatment in three cases terminating fatally after operation would not encourage

surgical intervention, unless the circumstances of the case were very exceptional.

In the Hunterian Lectures referred to, attention was drawn to post-operative hæmatemesis, of which we have seen several cases—four fatal. The cases occurred after operations for intestinal obstruction, tuberculous peritonitis, herniotomy, ovariectomy, and gall-bladder operations. Other cases have since been reported—one by Dr. Winslow (*Lancet*, October 20, 1900, p. 1900) in a stout woman, aged sixty-five years, after operation for umbilical hernia, where death occurred from profuse gastrorrhagia on the third day; and at the post-mortem examination, though the stomach and intestines contained a large quantity of blood, no vascular lesion could be discovered; and another by Mr. C. W. Mansell-Moullin (*Lancet*, October 20, 1900, p. 1900) in a young man, aged twenty-three years, who died from profuse hæmatemesis within forty-eight hours of a simple exploratory incision in the left iliac fossa. Post-operative hæmatemesis was then neither generally recognised nor well understood, but since that time several papers have appeared on the subject both at home and abroad, and, though now fully recognised, its cause remains obscure. Professor von Eiselsberg tried to explain it as a result of injury to the omentum from several cases observed in the Königsberg Klinik after operations involving ligature of the omentum, after proctectomy for cancer, and after torsion of the omentum. Although this explanation may serve as a cause, it does not account for all cases, as proved by one in which a malignant tumour of the common bile-duct causing jaundice and distended gall-bladder was operated on under cocaine (A. W. M. R.), the distended gall-bladder being simply exposed through a small incision, stitched to the parietes and drained, without in any way exposing any other viscera; yet violent hæmatemesis set in the day after operation, and proved fatal in three days. This case also disproves two other theories that have been advanced—one, that general anæsthesia is the cause, and another, that sepsis affords an explanation, the latter being a theory advanced by Dr. Rodman in his oration before the American Medical Association in June, 1900. That sepsis was

not the explanation in the cases in which the opportunity has occurred of observing the condition after death is undoubted, for in each there was no sign of peritonitis or other septic trouble; and, moreover, there was no gross evidence of ulcer or other injury to any vessel of sufficient size to be visible to the naked eye. The theory of sepsis is also negatived by recovery in the greater number of cases, and by there being no sign of distension or any of the other usual concomitants of septicæmia when it occurs after abdominal operations. The only explanation that seems at all feasible is that the hæmorrhage is dependent on a reflex nervous influence, and it is quite possible that this same explanation applies to vicarious hæmatemesis at the menstrual period; but it should also be remembered that slight erosion of the mucous membrane of the stomach, sufficiently deep to cause severe gastrorrhagia, may be almost imperceptible to the naked eye, even when searched for carefully on the post-mortem table. Though serious, it is not necessarily fatal, and I have known several cases yield to general treatment, such as high injections of hot water at a temperature of from 112° to 116° F., as advocated by Tripier, free purgation by calomel, the stopping of all mouth-feeding, and the application of ice to the epigastrium, etc. In post-operative hæmatemesis, operation can be seldom feasible or advisable, and Reichard's experience of operations followed by death in two cases would lead one in the future, as in the past, to rely on general rather than on surgical treatment.

Venous hæmorrhage, if from perforation of one of the large trunks, such as the coronary, splenic, or portal, may cause rapid death; but, owing to the diminished pressure in the veins and the more languid circulation, a rapidly fatal result is less likely than in arterial bleeding, and should the hæmorrhage persist or recur, such cases would be likely to benefit by surgical treatment.

Arterial bleeding is mostly responsible for the serious and fatal hæmatemesis due to gastric ulcer. The bleeding may be from the small arterioles which radiate between the peptic glands, from the trunks along the curvatures (the coronary being the most frequently affected), or from extrinsic arteries,

the splenic alone being responsible, according to Brinton, for 55 per cent. of the deaths in fatal hæmatemesis.

The following list of 54 fatal cases of hæmatemesis is taken from M. Savariaud's thesis: Ulcerations of the splenic artery, 17 cases; ulcerations of the coronary artery, 6 cases; ulcerations of the pancreatico-duodenal, 7 cases; ulcerations of the gastric arterioles, 10 cases; branches of the coronary vein, 2 cases; other veins, 2 cases; vessel not determined, 2 cases; no vascular orifice visible, 4 cases;



FIG. 33.—STOMACH SHOWING LARGE VARICOSE VEINS.

Perforation occurred at two places and led to fatal hæmorrhage.
(No. 2,402, Royal College of Surgeons' Museum.)

vessel not mentioned, 4 cases. The pancreatico-duodenal and right gastro-epiploic are the arteries chiefly affected in pyloric and duodenal ulcers. The peculiarly fatal nature of hæmorrhages from medium-sized arteries depends on the fact that an ulcer makes a lateral opening into the vessel which prevents natural hæmostasis by retraction and contraction of the artery. The whole force of the heart is then exerted on the clot, which tends to form during the syncope that usually occurs when a large quantity of blood is suddenly poured out.

The interval between the first onset of bleeding and death is of great importance surgically, and is well shown in the

table from M. Savariaud's thesis, which is therefore worthy of note :

Vessel.	No. of Cases.	Sudden Death.	Rapid Death.	Survived considerable Time.
Heart	4	I	I	2 (3 days)
Aorta	2	—	I	I (10 days)
Hepatic	2	—	I	I (10 days)
Splenic	17	3	7	7 (2 to 8 days)
Coronary	6	I	3	2
Pancreatico-duodenal	6	I	3	2 (8 to 15 days)
Arterioles	10	I	I	8 (4 to 15 days)
Small veins	4	I	I	2 (7 to 11 days)
Invisible veins ...	3	—	I	2 (21 days)

It shows that in the present state of our knowledge it is impossible to diagnose the size of the vessel perforated, either from the amount of blood lost or the length of survival.

A probable diagnosis of the site of the bleeding may, however, often be arrived at in hæmatemesis from ulcer by a careful study of the previous history, especially with regard to the site of pain, the time of onset after food, and the influence of posture, as well as by the direction in which the pain radiates. The situation of the tender spot, the presence or absence of tumour, and of dilatation or contraction of the stomach, also afford assistance.

As will be seen later, the diagnosis of the site of the ulcer, and therefore presumably of the bleeding, is of great importance from a surgical point of view, and will influence both the advice given as to treatment and the method of procedure when the abdomen is opened.

Treatment.

From the fact that medical and general treatment is successful in arresting hæmatemesis in 93 per cent. of cases, and that it is difficult in the present state of our knowledge to say at first that the bleeding is not occurring from capillaries or small arterioles, it necessarily follows that medical treatment should always have a fair trial in every case of acute hæmatemesis. The very fact of medical treat-

ment being so often successful in cases of apparently alarming hæmatemesis goes to show that capillary oozing or bleeding from arterioles is much more common and accounts for many more cases of gastric hæmorrhage than has hitherto been supposed; but while thoroughly believing this, we must also not close our eyes to the experience we have in general surgery of bleeding from medium-sized arteries, such as the radial or ulnar, which we know would rapidly bleed a patient to death if the vessel were perforated on one side and surrounded by warm compresses, a condition that practically applies in all cases of hæmatemesis where the larger vessels are eroded.

If, therefore, medical treatment and rest properly carried out are not successful in arresting the bleeding in a few hours, or if after being arrested the bleeding recurs, we should be driven to the conclusion that a large vessel is perforated; and if a surgeon has not been previously asked to see the case, we would say emphatically that a surgical consultation ought to be held with a view to considering the question of operation and immediate arrest of the bleeding by direct treatment if the patient is in a fit condition to bear it, just as would be the case if an ovarian artery were bleeding in a case of ruptured extra-uterine gestation, or a brachial or radial after an accident.

The views here enunciated are perhaps more pronounced and more emphatic than those expressed in the Hunterian Lectures of 1900, this being the result of a much extended experience in the surgery of the stomach, a much greater success on all hands in the surgical treatment of stomach diseases, and a careful study of more recent statistics.

An analysis of the table of M. Savariaud of 54 cases showing the prolongation of life in various fatal cases of hæmatemesis, demonstrates that in 10 out of 54—that is, in 18·5 per cent.—death occurs so rapidly that there is barely time to consider the question of surgical treatment, and that in 17 out of the 54, which equals 31·4 per cent., death occurs within from twenty-four to thirty-six hours after the first appearance of hæmorrhage. Now, although at present these cases are often allowed to die without operation, yet if the

bleeding were from a radial or tibial, or any accessible artery, they would all be saved by the simple operation of direct ligature of the bleeding vessel, an operation which would also cure the bleeding stomach artery could it be readily found. The difference between the two is, however, not only one of accessibility, but also one of diagnosis; for if we are able to diagnose capillary hæmorrhage, the case will be generally one for medical treatment alone, but if the time arrives when we can diagnose with great probability arterial hæmorrhage from a large vessel, the case will, we believe, be considered one for the adoption of surgical measures. Our efforts, both as physicians and surgeons, must therefore be directed towards making a diagnosis of the size of the damaged vessel, for if it can be asserted that in all probability a large artery has given way, an operation could be undertaken in an early stage of the case, before exhaustion and profound anæmia have supervened, with great probability of success.

Where there have been distinct signs of gastric ulcer preceding the hæmorrhage, and where a sudden hæmatemesis has occurred, with great loss of blood, accompanied by an attack of syncope, a large vessel will usually be found to be the source of the bleeding. In all such cases not speedily yielding to medical and general means, surgical treatment will probably in the future be carefully considered, and in some it will be followed out; for there can be no absolute rule formulated that will apply to every case, and each must be considered on its merits. The present condition of the patient, the previous history, the surroundings, the possibility of skilled surgery and of good nursing, and other like circumstances, will all help in the decision.

Although both surgical and medical treatment in cases of fulminating hæmorrhage have so far yielded disappointing results, in the remaining 50 per cent. of fatal hæmorrhages, where repeated bleedings occur, and the interval between the first seizure and death varies from a few days to two or three weeks, medical treatment will have been fully tried and failed, and there can be no question as to the advisability of surgical procedures being adopted.

At present, with the exception of Dieulafoy, who advocates operation during the first bleeding if as much as $\frac{1}{2}$ litre of blood is lost, all other surgeons who have written on the subject agree that general means ought to be relied on during and after a first attack, as in from 93 to 95 per cent. of cases such treatment succeeds, and until our means of diagnosis as to the size of the vessel injured is rendered more reliable we must assent to this rule; but after a second bleeding we have no hesitation in advising operation, even during the course of the hæmorrhage if the patient can bear it, or as soon after as his condition will permit the operation to be done: for experience tells us that further hæmorrhages are almost certain to occur unless preventive measures be adopted. One of us (A. W. M. R.) saw a case of this kind which created a great impression. A single woman, close on thirty, was seen, with a view to operation, after a second attack of hæmatemesis, which had, however, then ceased, and as the patient, though anæmic, was apparently much easier, and expressed herself as feeling well, operation was deferred; but a third attack, which occurred a few days later, proved fatal.

In another case, operated on during the third attack, the bleeding vessels were found and ligatured, and the patient was saved.

Doubtless the desirability of stopping bleeding from an ulcer of the stomach by surgical means must have occurred to many minds before being put into execution. To Mikulicz, however, belongs the claim of having been the first to operate for hæmorrhage from a gastric ulcer, on February 13, 1887. Roux of Lausanne was the first to perform a successful operation in a case of hæmorrhage from the coronary artery, in which he excised the ulcer and ligatured the artery at both ends. In the Hunterian Lectures a table of all the cases of operations for hæmatemesis was given; it included operations for post-operative and vicarious hæmorrhage, cases not associated with ulceration, and all ending fatally. Excluding these and correcting Hartmann's series, it would give 26 cases of acute hæmatemesis, with 14 deaths, and 19 cases of chronic hæmatemesis, with 2 deaths; otherwise a

mortality of 53·8 per cent. in acute, and of 10·5 per cent. in chronic, hæmatemesis treated surgically. A more recent table has been drawn up by Dr. Rodman (*Philadelphia Medical Journal*, June 9, 1900), in which he has collected 32 operations for acute gastrorrhagia, with 13 deaths, or a 40·6 per cent. mortality, and 31 operations for frequently-recurring, or so-called chronic, hæmorrhages, with 6 deaths, or a mortality of 19·3 per cent.; and even since that list was drawn up other operations have been performed. This mortality is very high, but it must be remembered that in every case medical treatment had been first tried, and in many of the cases probably over too long a period before operation was performed; for instance, in one of the cases given, in which one of us (A. W. M. R.) operated successfully during the third seizure, the blood seen at the operation was so diluted and thin as to be more like water tinged with blood than blood itself, yet the bleeding was still going on. Moreover, it is to be remembered that gastric surgery is advancing in safety and efficiency by leaps and bounds, and will, we feel sure, be one of the most satisfactory branches of the surgeon's work.

Technique of Operation for Gastrorrhagia (Exploratory Gastro-tomy).—On account of the fear of exciting fresh hæmorrhage, it is undesirable to wash out the stomach before operating on a bleeding ulcer; and as the patient is usually anæmic, and will therefore bear shock badly, it is desirable to have him enveloped in cotton-wool or otherwise kept warm on a heated table, and to give him a subcutaneous injection of strychnine before operation. If it be unnecessary to infuse saline fluid before the operation, an assistant should be ready to perform that duty while the abdominal operation is being proceeded with, should it be called for. After the abdomen is opened, the stomach may be emptied by pressing the contents into the duodenum, as suggested by M. Terrier. This saves much time, and rapidity is of great importance. The surface of the stomach should then be carefully examined, as very frequently a puckering of the surface or thickening of the coats will be noticed at the site of the ulcer, or a difference in colour may sometimes indicate

its site. Should the operator be fortunately able to find these indications, much time may be saved; but if no indications of this sort be obtainable, the stomach must be drawn well forward and opened, either by a vertical incision, which gives less hæmorrhage, or by an incision in the long axis of the stomach, which affords a much better view of the interior. In order to avoid soiling the peritoneum, thin, flat sponges should be placed within the

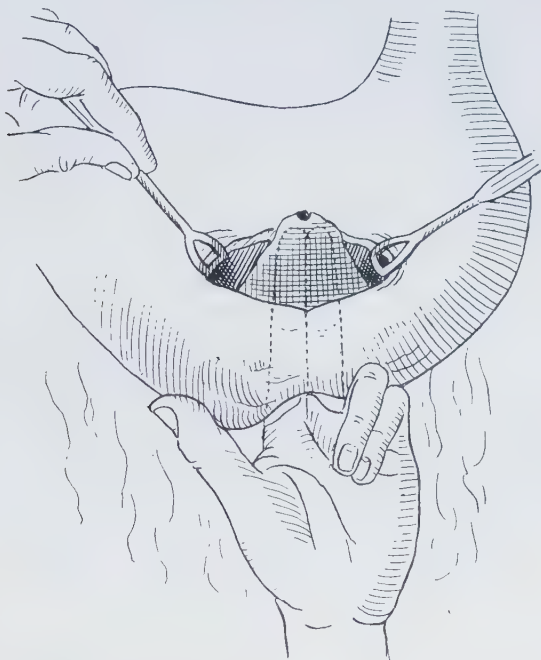


FIG. 34.—METHOD OF EXPOSURE OF ULCER.

abdomen, and it is well to have a perforated sterilized gauze pad covering the stomach, the opening to correspond with the opening in the stomach. The edges of the stomach should then be held open by forceps, one above and below, and one at each end.

The interior of the stomach must now be systematically examined—first the anterior and posterior surfaces, then the upper and lower curvatures, and lastly the pyloric and

cardiac orifices, all of which can be done by the naked eye, or by the aid of an electric cystoscope or a reflected light. If the posterior wall of the stomach cannot be sufficiently examined, a slit may be made in the omentum, and two fingers, or even the whole hand, pushed through it, and employed to invaginate the posterior wall. If no ulcer can be found on the wall of the stomach, the duodenum should be explored, not only by the finger, but by invagina-

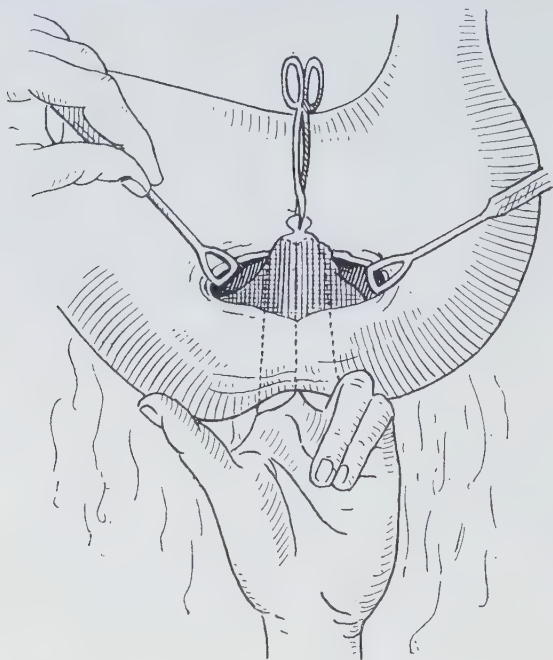


FIG. 35.—LIGATURE OF BLEEDING-POINT.

tion. If no ulcer be found anywhere, and the bleeding proves to be capillary or from small undiscoverable ulcers, gastro-enterostomy should be performed; but if an ulcer be discovered, and it be possible to excise it, that operation should be done, as it undoubtedly offers the likeliest method of cure. After excision of the ulcer and ligature of the bleeding vessels, the edges of the wound are brought together by sutures, of which one or two layers may be

employed. Should the excision involve the peritoneal coat, it is desirable to apply Lembert's sutures, and if it be on the posterior wall the operation may present some, though not insuperable, difficulty. Should the ulcer be discovered in some region where excision is impracticable—for instance, near the cardiac end—the method adopted by Mikulicz, in his first operation, in 1887, of applying the cautery, may be employed. This seems to have answered well in several cases, and where death occurred afterwards it was not from a recurrence of the bleeding. In a case of this kind gastro-enterostomy is also advisable, by way of setting the stomach at rest. If any superficial bleeding-points be discovered, they may be caught up by forceps and ligatured; but this is more easily said than done, as the mucous membrane is very friable, and a ligature, if drawn at all tightly, tends to cut its way through. Moreover, forceps easily tear the mucous membrane, and may produce a larger bleeding area. The method of ligature *en masse* may be employed if the ulcer is small; it has proved serviceable in several cases—for instance, in Case 4, which will be described presently—and it is easy of application when the ulcer can be reached.

The method has been tested by experiments on animals by Dr. Eisendrath (*Annals of Surgery*), and has been shown to endanger perforation if the serous coat be taken up, except when supported by external sutures. Ligature of the main arteries of the stomach was suggested theoretically by Savariaud when no bleeding ulcer could be discovered; it does not, however, commend itself as being safe or likely to be efficient. Should the bleeding be from an ulcer at the pylorus, the operation of pyloroplasty may be performed, the ulcer being excised, and the edges of the gap left by the excised ulcer, as well as the edges of the incision, being united, so that the line of sutures shall be transverse to the axis of the pylorus. We should not, however, advise pyloroplasty when there is active ulceration of the pylorus, unless the ulcer can be completely excised; for in three cases of this kind there have been subsequent disappointments, owing to contraction in healing. In one case the

patient made a good recovery from the operation, but subsequently suffered from stenosis, for which a further operation had to be done. In a second case recovery took place, and the patient regained his lost weight; but subsequently a tumour of the pylorus developed, which was thought to be cancer, and for which pylorotomy had to be performed. In the third case perforation subsequently occurred. We think, therefore, that in cases of ulcer of the pylorus, where a clean excision of the pylorus cannot be done, it would be better to perform gastro-enterostomy or pylorotomy, whichever at the time may appear to be the easier.

Wherever the pylorus is adherent, as it is in so many cases of ulcer, we should certainly prefer gastro-enterostomy; but if the pylorus be extensively ulcerated and free from adhesions, pylorotomy can be almost as quickly performed as gastro-enterostomy, seeing that the pylorus is already in the hand.

Although the operative treatment of parenchymatous or capillary hæmorrhage by any surgical method would seem to be of doubtful value [for, according to a report by Petersen (*Medical Press*, 1899) from Czerny's clinic, of three cases operated upon for severe parenchymatous hæmorrhage from vicarious menstruation, operation entirely failed to relieve, and of other two cases of post-operative parenchymatous hæmorrhage by Reichard (*Medical Press*, January 3, 1900) both died], yet if such cases, owing to persistence, seem to call for operation, then gastro-enterostomy, by securing complete physiological rest, would seem to offer the best chance of success.

In performing gastro-enterostomy our recent experience has led us to prefer the posterior operation, which may be modified by using Mayo Robson's decalcified bone bobbin as a hollow splint over which to apply the double continuous suture, uniting the mucous and serous margins of the openings between the viscera, thus securing an immediately patent channel between the stomach and jejunum, and a temporary protection to the line of union. We may say that our last thirty or more posterior gastro-enterostomies have

recovered without regurgitant vomiting or other untoward symptoms.

The conclusions we would urge concerning the treatment of bleeding gastric ulcer are that—

1. In recurring, or so-called chronic, hæmatemesis from gastric ulcer, surgical treatment is decidedly called for.

2. In acute hæmatemesis, further accuracy in diagnosis as to the size of the bleeding vessels is urgently needed, and the co-operation of the physician and surgeon is advisable in all cases of hæmatemesis, so that, if relief be not obtained by medical and general treatment, surgical means may be adopted if the bleeding is believed to occur from a large vessel; but seeing that capillary hæmorrhage is capable of relief by medical means alone, medical should always precede surgical treatment in such cases.

The following are brief descriptions of all the cases of acute hæmatemesis on which one of us (Mayo Robson) has operated:

CASE 1.—Acute hæmatemesis from ulcer of duodenum close to pylorus, eroding gastro-duodenal artery. Anterior gastro-enterostomy with Murphy's button.

The patient was a man, aged thirty-six, who after a year's history of ulcer of the stomach, with great loss of flesh and strength, was suddenly seized with profuse hæmatemesis, which was followed in twenty-four hours by a second seizure. When seen he was extremely weak and very thin and anæmic, and looked as if he must die if further hæmorrhage occurred. His pulse at the time of operation was 150.

The history clearly pointed to the pylorus or duodenum as being the seat of the bleeding, but the patient was too ill to bear pylorotomy, and an anterior gastro-enterostomy was performed by means of a Murphy button, the whole operation only occupying fifteen minutes. He bore the shock well, and for five days made good progress. On the sixth day he was suddenly seized with severe abdominal pain, and from that time he lost strength. Vomiting set in on the eighth day, and he died on the tenth. No further bleeding occurred, and at the necropsy a duodenal ulcer opening into the gastro-duodenal artery was found. The cause of death was peritonitis, the result of a leakage when the button began to separate.

So far as the hæmorrhage was concerned, the gastro-enteros-

tomy had been completely successful, and the vessel, though perforated at one side, was occupied by a firm clot.

CASE 2.—Pyloric ulcer ; hæmatemesis. Gastro-enterostomy.

Mr. C., aged forty-four, was sent by Dr. Peter MacGregor, of Huddersfield, on January 2, 1900, with the history that he had had pain after food, together with other symptoms of gastric ulcer, for four years, though his first attack of vomiting blood occurred in May of the previous year. The bleeding was rather profuse, but under medical treatment and rest he recovered and was able to resume his occupation. A week before he was sent, there had been a recurrence of the hæmorrhage, which was repeated three days later.

On his arrival at the surgical home he was in a state of collapse with a barely perceptible pulse. There was well-marked dilatation of the stomach, with tenderness over the pylorus. The history of the pain occurring one and a half hours after food, together with the site of the tenderness and the presence of a large amount of blood in the motions, left no doubt but that the ulcer was at or near the pylorus. As the bleeding had recurred twice in the week, and was probably persisting and passing into the bowel, operation was decided on. This was done on January 4. As the patient was in such a feeble condition, every precaution was taken to guard against shock, and it was decided only to perform gastro-enterostomy, as it was quite clear that he would not stand any prolonged search for the bleeding-point. A posterior gastro-enterostomy was therefore done, a decalcified bone bobbin being used to make the anastomosis. His temperature and pulse were never above normal, and he made an uninterrupted recovery. He was fed by nutrient enemata for the first few days, only taking sips of water by the mouth ; but at the end of that time he was allowed to take milk and soda-water, and then gradually to have stronger food. He was up at the end of the third week, and returned home within the month.

A year later he was in perfect health, and had had no recurrence of his stomach symptoms nor any further bleeding.

CASE 3.—On July 6 one of us was asked by Dr. Humphery, of Armley, to see a patient, Mrs. H., aged thirty-three, who had been seized with violent hæmatemesis a week previously, the attack having recurred four days later, and again on the day we saw her. The patient had been anæmic before operation, and had had some slight indigestion, but otherwise did not consider herself ill, and she had been married only three months. On arrival we found her quite blanched and with a very rapid, feeble pulse ; but as the bleeding had resisted ordinary remedies, and as she was clearly going to die if unrelieved, though

it seemed a rather desperate procedure, we decided to give her the chance of relief by operation. She was removed by ambulance to a surgical home, and, as during the journey the bleeding began again, an operation was done without delay. A pint of saline fluid containing 1 ounce of brandy was given into the rectum, and 10 minims of liq. strychniæ were administered just before the operation, the patient being completely enveloped in cotton-wool. On opening the abdomen there were no indications on the surface of the stomach as to the situation of the bleeding ulcer. An incision was therefore made in the axis of the stomach, which enabled us to explore the interior. No less than seven bleeding-points were counted. As two of them were bleeding freely, they were taken up by artery forceps and the mucous membrane was ligatured *en masse*; the other bleeding-points stopped on exposure to air. We then rapidly closed the wound in the stomach and performed posterior gastro-enterostomy, using one of the bone bobbins as a splint over which to make the anastomosis. We had a little anxiety on account of shock for the first twenty-four hours, but by administering saline fluid by the bowel and injecting it freely into the subcutaneous tissue, together with the administration of several injections of liq. strychniæ, the difficulties were tided over, and the patient's further progress towards recovery was uninterrupted. She was able to take solid food in the second week, and when she left at the end of the month she could eat any ordinary food without discomfort. Six months later she had had no recurrence of symptoms and was well in every respect.

CASE 4.—Mr. F., a farmer, residing in Essex, was sent by Dr. A. J. T. White, on March 26, who kindly furnished the following history:

‘I first saw him five years ago; he had then occasional pain in the epigastrium, with much flatulence, and at times vomiting. This kept on at intervals more or less for three years. Eighteen months Dr. G. saw him with me. At that time, instead of his former weight of 16 stones, he only turned the scale at 12 stones. He then improved gradually for about three months, and gained about a stone in weight. Six months later, or about a year ago, he, while out driving, had some abdominal pain, and vomited considerable quantities of blood. He continued being sick and suffering pain for some time, with slight hæmatemesis and melæna, but again improved. About three or four months ago he got worse, and has been vomiting and suffering considerable pain on and off ever since. I have very little doubt but that his original trouble was gastric ulcer, but my fear now is lest malignant ulceration should have supervened, and some time

ago I asked him to see you. He could not go then, as he had various business matters to set right, but now is willing. He is a man of iron will and constitution, though terribly pulled down.'

On Mr. F.'s arrival in Leeds, he went direct to a surgical home, his weight then being 10 stones. He was then suffering severe pain, but was able to take a little milk, which was, in fact, the only form of food he had been able to digest for a long time. Within a few hours he was seized with violent hæmatemesis, and vomited 5 pints of clots and dark fluid mixed with mucus. Rectal feeding was at once adopted, and an ice-bag applied to the epigastrium. The next day much coffee-ground material was vomited, and on the third day the bleeding ceased. An operation, which was clearly demanded, was arranged for March 22, but on the night of the 21st he again vomited three pewters full of pure dark blood, which clotted soon after being vomited. The stomach was quite empty of food, as after the night of his admission feeding had been entirely rectal. He was now extremely weak, but, as the vomiting and bleeding were continuing, Dr. White agreed with me that it would be better not to postpone operation, for he was rapidly losing ground, and clearly could not stand a greater loss. An hour before operation he vomited blood freely again. On the morning of March 22 the abdomen was opened, and the lesser curvature of the stomach found to be much indurated, forming a tumour. There was also much puckering of the surface of the stomach, and the glands in the greater and lesser omentum were enlarged but discrete. A posterior gastro-enterostomy was performed, a bone bobbin being used. In order to guard against shock, he was enveloped in cotton-wool, had 10 minims of liq. strychniæ (B.P.) given subcutaneously before operation, and had a pint of saline fluid, with an ounce of brandy, given into the bowel. Immediately after operation, which was finished within the half-hour, nearly a pint of saline fluid was injected into the subcutaneous tissues of the axilla, and another pint, together with an ounce of brandy, administered per rectum. During the day three injections of 5 minims of liq. strychniæ were given, and the rectal enemata were repeated. Very little shock was felt, and the after-progress was uninterrupted. The bowels were moved on the third day, and the wound was dressed and found healed on the 10th. No more blood was parted with, and stomach feeding was begun four days after operation. By the end of the week he was taking as much as 5 pints of fluid nourishment in the twenty-four hours. He said he had never had any pain since the operation, and was feeling better than he had done for a long time. He had lost all

the acid eructations, the constant burning at the epigastrium, and the flatulency.

Four is not a large number of cases to give as examples, but the treatment of hæmatemesis by operation is a comparatively new operation, and only few cases have been reported. Had it not been for the accident of leakage when a Murphy button was beginning to separate, there would have been no casualty in the list; but that is an accident which can be avoided by employing sutures around a decalcified bone bobbin, which is now our regular custom. Undoubtedly, without operation all the patients would have died. The cases present individual points of interest.

In three cases—the first, second, and fourth—gastro-enterostomy, by securing physiological rest and freedom from the irritation due to hyperacidity of the gastric juice, which is usually present in ulcer of the stomach, completely arrested the bleeding.

The third case illustrated the feasibility of exploring the stomach even in a patient brought very low by excessive loss of blood; and although the ligature of the chief bleeding-points was effected, it was deemed advisable to secure rest to the stomach by performing a posterior gastro-enterostomy, especially as this could be done without materially prolonging the operation.

CHAPTER X

THE COMPLICATIONS OF GASTRIC ULCER (*continued*)

Perforating Ulcer of the Stomach.

PERFORATION of an acute ulcer of the stomach is one of the most serious and appalling catastrophes that can befall a human being.

Perforation may be **acute**, **subacute**, or **chronic**.

In **acute** perforation the giving way of the base of the ulcer is sudden, and the contents of the viscus are at once free to escape into the peritoneal cavity.

In **subacute** perforation, which probably occurs when the stomach is empty, or when some adhesions are present, or the opening is quickly plugged with omentum, the symptoms are similar in kind to, though less in degree than, those of acute perforation.

In **chronic** perforation the process of ulceration has been sufficiently languid to permit of protective adhesions forming, so that the field available for the escaping contents is a limited one. The gradual penetration of the stomach coats has induced a plastic peritonitis, resulting in adhesions, and a localized abscess cavity is formed.

Acute and Subacute Perforation.

1. **Frequency.**—The frequency of perforation in cases of gastric ulcer has been variously estimated by different writers. The extreme assessments are 6·5 and 28·5 per cent. The mean of all recorded cases is not an accurate index to the general liability, for a very striking difference is observed in the statistics collected in various countries.

Tinker, Finney, and others, have remarked on the immunity which exists in the United States. Lebert noticed perforation in 12 per cent. of his own cases. In Fenwick's own series of 112 cases, perforation was observed in 28·5 per cent., and in a series of 678 autopsies in 22·8 per cent. Brinton states that perforation occurs in from 13 to 15 per cent., and Habershon in 18 per cent. In England the percentage may be stated to be approximately 15 to 20.

2. **Site of the Ulcer.**—The treatment of perforation of a gastric ulcer by operation necessitates as accurate an estimate as possible of the locality of such ulcers. Pariser and Lindner state that, of 200 cases of gastric ulcer, 190 will be on the posterior wall, and of these 4 will perforate; 10 will be on the anterior wall, and of these 8½ will perforate. Brinton estimated that 70 per cent. of all perforations occur on the anterior surface of the stomach, 21 per cent. on the lesser curvature, and only 9 per cent. on the posterior wall. Ulceration is more frequently found near the pylorus, but perforation is more common near the cardiac extremity. Fenwick, from a study of operation cases and post-mortem records, remarks that 'whereas the acute disease usually perforates the comparatively thin coats of the stomach in the cardiac half of the viscus, close to the lesser curvature, and on the anterior surface, the chronic form of the complaint is most prone to perforate in the pyloric portion of the organ on the posterior aspect near the upper margin.' The greater liability of an ulcer of the anterior wall may be due to the fact that it lacks the support derived from viscera that is accorded to the posterior wall. Protective adhesions are therefore less likely to form.

The ulcers which lead to perforation may be multiple. In 20 per cent. of the recorded cases there were more perforations than one. Rarely a perforation of a gastric and duodenal ulcer may occur together.

3. **Sex.**—Perforation is seen more frequently in women, especially young women—and among them in young servant girls—than in men. Allowing for the greater frequency of ulcer in women, we find that *relatively* perforation is more frequent in men, especially in men over the age of forty.

4. **The size of the perforation** may vary widely. In some cases the opening is hardly larger than a pin-prick; in others it readily admits two fingers. The importance of this variation is probably considerable. A small perforation, especially when the stomach is empty, will permit the least trickle of fluid, and will become readily and completely blocked by an omental plug. A large perforation occurring when the stomach is full leads to the flooding of the cavity with a torrent of fluid and the sudden overwhelming of the peritoneum. The swiftness and suddenness of the onset and the severity of the symptoms are not improbably measured, therefore, by the size of the perforation and the state of repletion of the stomach.

Bacteriology.

The bacteriology of acute perforation has been most unaccountably neglected. Hamburger, Kitasato, and others, have shown that practically every pyogenic organism is found, at certain times and under certain conditions, in the stomach contents. It is doubtful whether the stomach ever, in usual health, is sterile, even when empty or nearly so. The gastric juice has a certain influence inimical to germ life, but, according to Finney, there are many organisms that successfully resist it, and even remain for a longer or shorter period in the deeper layers of the mucosa, ready to exert their baleful influence whenever a perforation affords them opportunity. Very few and very inadequate observations have been made upon the peritoneal contents after acute perforation. It is more than likely that information derived from examinations of the exudate taken at the time of the operation will have important value in the question of prognosis. The condition of the peritoneum, of the fluid it contains, of the gas escaping from it, of the massive clouds of lymph, is vastly different from that seen in cases of septic peritonitis, however arising. Yet in all text-books the statement occurs repeatedly that perforation causes immediate septic peritonitis.

Symptoms.

Acute Perforation.—The perforation of a gastric ulcer may or may not be preceded by the symptoms and signs of ulceration. Symptoms are often lacking when an ulcer is situated on the anterior wall of the stomach; and as such an ulcer is more liable to perforation, the absence of characteristic symptoms is readily understood. If a history suggestive of ulceration can be obtained, the diagnosis of perforation in any abdominal catastrophe becomes simpler. In a certain, though small, proportion of cases (about 8 per cent.) no history of antecedent gastric disablement can be elicited.

The initial symptom is almost constantly a sudden, sharp, stabbing pain, altogether intolerable and overwhelming, in the epigastrium. Not seldom the patient remarks that something 'has given way' in the abdomen, and a feeling as of the trickling or gushing of fluid may be remarked. The pain may be limited in area, or may radiate to the shoulders or interscapular region; rapidly it invades the whole abdomen. There is immediately, or within a very few moments, a condition of collapse of varying profundity, but generally most severe. The face is drawn, and the expression tells of agony and anxiety and of the fear of present or impending disaster. The surface of the body is pale, and cold, and clammy, the lips livid, the face blanched, and there is a tinge of blueness in all the skin. The respiration is shallow and hurried, the pulse rapid, thin, or almost imperceptible. Vomiting, with or without bleeding, is an inconstant symptom. Finney finds it recorded in 40 per cent. of cases, Fenwick in 29 per cent. Probably its occurrence depends upon the amount of fluid in the stomach, the size of the ulcer, and the depth of the collapse. Traube explains its infrequency as being due to the ease with which the contents escape through the gap made by the ulcer, an explanation which is in no degree convincing. Thirst is urgent, distressing, and unquenchable. The urine is scanty, and may, indeed, be wholly suppressed. At the first the abdomen is hard and retracted, the muscles tight and fixed as a protecting and unyielding splint, ensuring rest. Gradually, however, the abdomen fills with gas

and fluid, and a bulging of its walls is seen. Liver dulness is then generally absent, but its presence or absence is void of any significance, and is unreliable as an aid to diagnosis. The whole abdomen, but more especially the upper half, is tender, and the patient shrinks from the contact of the surgeon's hand. Death may occur during the stage of collapse (in 4 per cent., Fenwick). In rare cases death may seem almost instantaneous. If the patient rallies, the symptoms and the signs are those of general peritonitis. The severity of the instant shock and of the subsequent peritoneal reaction varies within wide limits, and is doubtless dependent upon the size and position of the perforation, the character and quantity of food in the stomach, and the severity of the vomiting. The sudden incidence of a marked leucocytosis is considered an important diagnostic sign by Finney. That it is not always reliable has been shown in several cases. Its precise worth and significance must be determined by future observation.

Subacute Perforation. — Subacute perforation probably occurs when the stomach is empty or nearly so, or when a few filmy adhesions have formed which check the rapidity of the peritoneal invasion. The symptoms are of the same type as those described, but they are less brusque in their onset and throughout less vivid. There will be pain, sharp and stabbing, followed by sickness, faintness, and a degree of collapse. All these are much less marked than in the acute form, though they may, at the end of two or three days, develop rapidly, and end the patient's life in a few hours. Subacute perforation implies a less extensive, as well as a less acute, infection of the peritoneum. In some cases there may be a gradual merging into those classed as 'chronic,' where, inflammation being limited in area, a localized abscess forms. (For examples see section on Gastrolysis.)

Differential Diagnosis.

The conditions likely to be mistaken for acute perforating ulcer of the stomach are those which result from sudden intraperitoneal disasters. Such are acute perforating ulcer

of the duodenum, ruptured tubal gestation, acute intestinal obstruction, acute hæmorrhagic pancreatitis, thrombosis of the superior mesenteric vein, and acute perforative appendicitis. When ulcers of the pyloric antrum or of the duodenum perforate, the visceral contents will run downwards to the right iliac fossa, and, there setting up peritonitis, may cause symptoms which mimic with remarkable success those resulting from acute appendicitis. Other conditions which may resemble perforating ulcer in their symptoms are oncoming pneumonia, with its sudden pleuritic pain; acute poisonings; acute dilatation of the stomach; and acute inflammatory conditions in the gall-bladder. A minute examination of the patient and a careful attention to the history will enable a correct diagnosis to be made in nearly all the cases. The fact that in 92 per cent. a previous history of gastric ulceration can be obtained is helpful, but may be misleading.

The two following cases may usefully be contrasted and compared. In the first a perforating gastric ulcer resembled in its symptoms a case of extra-uterine gestation, and in the second an extra-uterine gestation had to be distinguished carefully from a perforating gastric ulcer.

PERFORATING GASTRIC ULCER SIMULATING RUPTURE OF EXTRA-UTERINE GESTATION. OPERATION; RECOVERY.

On January 18, 1899, one of us (Mayo Robson) was asked to see a patient at the Station Hotel, Leeds, and to come prepared to operate for probable rupture of an extra-uterine gestation. The history given was that the patient, Mrs. P., aged twenty-nine, had been suddenly seized at the station with acute abdominal pain, followed immediately by collapse, in which condition she was removed to the hotel.

Her last regular 'period' had occurred seven weeks previously, and having missed the next 'period,' and thinking herself to be pregnant, she took an ecbohc five days previously, which brought on severe gastro-intestinal disturbance and fainting. Three days later—that is, two days before the attack in question—she had had some uterine hæmorrhage, but no stomach symptoms complained of; and it was only on close inquiry later that any history of indigestion was obtained. Dr. Macrae saw her four hours after, and found liver dulness present. No abdominal disten-

sion; no rigidity of recti; some fulness in left loin and tenderness over left ovary. On vaginal examination there was fulness in Douglas's pouch and an indefinite fulness in the left fornix. When we saw her later the pulse was 130 and she was pallid and collapsed. A diagnosis of rupture of an extra-uterine gestation was made, and the abdomen opened above the pubes, when odourless gas escaped and a little fluid. The small suprapubic incision was therefore closed, and one made above the umbilicus, when a small perforation was discovered in the centre of a large chronic ulcer near the cardiac end of the stomach, close to the upper border on the anterior surface. The edges of the ulcer were refreshed and brought together by sutures, but, as the tissues were very friable, an omental graft was sutured over the line of incision. The abdomen was wiped clean after the evacuation of a quantity of turbid fluid from the right renal pouch and the space between the liver and the diaphragm. A small gauze drain was employed, but, as the sequel proved, was needless, and it was removed the next day. Recovery was uninterrupted, and she returned home February 16.

She is now, and has been since, quite well.

In the following case, under the care of Dr. Johnstone, of Ilkley, the symptoms of perforation of gastric ulcer were mimicked to a degree which rendered diagnosis difficult:

Mrs. C. D., aged twenty-two, married twelve months, was seized suddenly with acute abdominal pain and collapse. There was a history of pain after food, and occasional vomiting, which might have been due to gastric ulcer or early pregnancy. A 'period' due three weeks before the sudden attack had been missed. The shock was combated with strychnine and digitalis. Dr. Johnstone, diagnosing a ruptured tubal gestation, called Dr. Scott and Mr. Jessop in consultation. The problematical history of gastric ulcer, a long-standing anæmia, the general distension of the abdomen, with tympany, and the absence of liver dulness, were considered suggestive of perforating gastric ulcer. An incision was made above the pubes, however, and a ruptured tube discovered and removed.

Treatment.

There can, we think, be no doubt that acute perforating ulcer of the stomach does occasionally heal spontaneously. We have on three or four occasions at least, in operating for various pathological conditions of the viscus, found ample

evidence of such in the guise of old peritonitis around and upon the stomach. Dense and widespread adhesions to the liver or abdominal wall are found, and on separating these the stomach may be opened at the site of an old ulcer in the anterior wall. In these cases, on subsequent inquiry, a clear history of some sudden catastrophe has been elicited—a catastrophe that doubtless occurred at the time of perforation, and probably ended happily only because of the empty condition of the stomach at the moment of rupture. Pariser has collected fourteen cases, and Hall six cases, of apparent perforation ending in recovery. But though such cases do exist, they form but a trifling proportion, and have been computed at the most at 5 per cent. of the whole number. Their occurrence, therefore, is no argument against the law of invariable and immediate operation in all diagnosed cases.

There are cases in which, owing to an absence of clearly-cut and unmistakable symptoms and signs, a doubt may exist in the mind of the surgeon as to the diagnosis. A perforation may be suspected, but a little hesitation is felt in proceeding at once to operation. In such a dilemma resource may be had to the 'lesser abdominal section,' the exploratory incision. This procedure has been strongly advocated by Mikulicz, Mayo Robson, Kocher, and Finney, and should be carried out under cocaine anæsthesia. An incision large enough to admit the finger is made, and is ample for purposes of investigation and diagnosis. If the exploration prove negative, no harm is done, no shock is felt, and the patient is none the worse; if the exploration prove positive, the incision may be extended under cocaine anæsthesia, or ether may be given.

Operation.—The first surgeon to advise and adopt operative intervention in perforation of a gastric ulcer was Mikulicz, then Billroth's assistant, in 1880. The first successful operation was performed in 1892 by Kriege (*Berl. Klin. Woch.*, December, 1892). One of the first cases in England, operated upon three days after perforation, was under Mayo Robson, in the Leeds Infirmary.

PERFORATING GASTRIC ULCER OPERATED ON IN 1888.

One of us (Mayo Robson) operated on a girl, aged seventeen, at the Leeds Infirmary in 1888, on October 18.

Unfortunately, the operation was not performed until the third day, when peritonitis was general.

The abdomen was flushed out and drained by a glass tube in the pelvis.

The perforation was the size of a shilling in the anterior surface of the stomach, and in a most favourable place for treatment, which was unfortunately adopted too late. Death occurred a few hours later.

An incision 4 inches long is made in or near the middle line of the abdomen, above the umbilicus. This may later need enlargement upwards, downwards, or obliquely, in order to permit free access to the ruptured point. As soon as the abdomen is opened, a rapid survey of the whole stomach surface is made. It is well to begin at the cardiac end, for it is here that perforation is most frequent. The left costal margin is well dragged upwards by an assistant, and gentle traction on the stomach is made, in order to bring the fundus well into view. If the anterior surface is sound, the great omentum, immediately below the greater curvature, is torn open to an extent sufficient to admit the index-finger, which then explores the posterior surface; or the great omentum is lifted up and the transverse mesocolon torn through, so as to open up the lesser sac, and bring into view the posterior surface of the stomach. A massive outpouring of lymph on the surface of the stomach affords generally a useful guide to the perforation. These flakes and bands are protective in character, and are densest in the area where most they are needed. On gently breaking through them, the ulcer will be exposed. When found, the perforation must be closed as speedily as possible. The ulcer may or may not be excised. There is probably no advantage in removing it, and a little time is wasted in so doing. The orifice, if small, may be closed by a purse-string suture. If more than a puncture, it should be closed by at least two layers of continuous sutures. If the walls of the stomach are, as is not seldom the case, easily lacerable, an

interrupted suture, or Halsted's mattress suture, is preferable. There are, though rarely, cases where, owing to excessive destruction of the wall or inaccessibility of the ulcer, the perforation cannot be stitched up. In such the omentum may be used to close the gap. Enderlen's experiments and those of Sundholm show that the omentum not only acts efficiently, but permits a subsequent restoration, apparently complete, of the stomach wall. In place of omentum, an adjacent coil of intestine may be stitched along the gap, and will effectually close it. If neither of these methods can, for any reason, be adopted, the best course is to drain the cavity freely by passing strips of gauze, or an indiarubber tube, or both, down to the ulcer.

After the perforation has been dealt with, the general peritoneal cavity must be cleansed as thoroughly as time will permit by sponging or hot flushing.

Flushing is generally necessary to insure cleanliness. Sterile salt solution at a temperature of 105° is, on the whole, the most satisfactory fluid. It should be introduced with the help of a glass funnel and a length of indiarubber tubing. The tube may readily be guided to all the peritoneal recesses, which should be filled to free overflowing with the solution. Especial pains should be taken to flush the space between the liver and the diaphragm, the kidney pouches, the iliac fossæ, and the pelvis. Flushing should be continued until the fluid returns clear. There is then no need to empty the peritoneal cavity, for the fluid is rapidly absorbed, and is probably beneficial. In all cases a drainage-tube should be passed down into the pelvis through an incision made just above the pubes.

If general septic peritonitis has developed, the following plan, advocated by Finney, may be adopted: One or more incisions, free enough to allow an examination of the entire peritoneal cavity, should be made. Through this the intestinal coils are withdrawn sufficiently to allow the operator to evacuate any peritoneal exudate, and thoroughly cleanse with warm salt solution and gauze pledgets all recesses and folds. The intestinal coils, which should be kept covered by an assistant with warm, soft sponges or towels during this

manœuvre, should then be cleansed as far as possible from exudate and lymph by irrigation and wiping with pledgets of gauze, and replaced in the abdominal cavity. Too much time should not be consumed in the cleansing, nor should the intestines be handled roughly, but it is difficult to exercise too much care in the peritoneal toilet.

As perforation in 20 per cent. of the recorded examples has occurred at two or more points, the surgeon should not be content with suture of the first ulcer discovered, but should satisfy himself that the stomach elsewhere is sound.

Prognosis.

The prognosis in ruptured ulcer of the stomach will largely depend upon :

1. The condition of the stomach, whether full or empty.
2. The time elapsing between perforation and operation.
3. The size and number of the perforations.
4. The presence or absence, and the severity, of the vomiting.

1. **The condition of the stomach**, whether full or empty. If the stomach has been recently filled, the food will be in solid particles of varying size, and will contain a variety, in number and character, of micro-organisms. Under such circumstances a perforation will probably be large, and will permit an escape of material of a kind best calculated to cause an intense peritoneal reaction. Symptoms will be of the acutest character, shock will be profound, and life will be seriously imperilled. If, on the other hand, the stomach is empty, there will be an escape of a little gastric secretion only, and the perforation will almost certainly be small. A little local peritonitis may alone result, symptoms will be less aggressive, and recovery will follow. Such are probably the circumstances in cases like those already mentioned by Pariser and Hall.

2. **The Time elapsing between Perforation and Operation.**—This is an element of conspicuous importance. The study of a large number of cases proves, beyond the possibility of question, that the shorter the period between the perforation

and operation, the greater the chances of success. The operations performed in each succeeding period of twelve hours after perforation have a gradually increasing mortality, as shown in the accompanying table :

	Total Cases.	Recovered.	Died.	Percentage of Deaths.
Under 12 hours ...	49	35	14	28·5
From 12 to 24 hours ...	33	12	21	63·6
" 24 to 36 "	16	2	14	87·5
" 36 to 48 "	2	—	2	100·0
Over 48 hours ...	33	16	17	51·5

The fact that the mortality from operation diminishes in those dealt with more than forty-eight hours after operation is readily explained. In such cases the perforation will almost certainly have been subacute, for the ordinary acute case is always moribund at the end of forty-eight hours.

3. **The Size and Number of the Perforations.**—If there is but one perforation, and that a small one, the condition is, symptomatically, subacute. If there are more perforations than one, and if any of these are large, the symptoms are the acutest conceivable.

4. **The Presence or Absence and the Severity of the Vomiting.**—Vomiting is present in 29 per cent. (Fenwick) or 40 per cent. (Finney) of the cases. At each act of vomiting, the stomach contents are ejected not only through the œsophagus, but through the perforation also. The more severe the vomiting, the greater the amount of the stomach contents thrown into the peritoneal cavity, and, concomitantly, the more severe the peritoneal reaction thereby induced.

Results.

There are few matters so difficult to deal with statistically as this. It is probable that the vast majority of successful cases are recorded, for each one is a triumph of surgical skill, each one indisputably means a life saved. On the other hand, in operating upon an unsuccessful case, the surgeon feels that he has merely made a powerless interference in the course of a certainly fatal disaster, and the record is consigned to oblivion.

It is, nevertheless, necessary to have some figures upon

which to base our statements of prognosis. In order to have a statistical basis, we have added to the cases tabulated by Mayo Robson in the Hunterian Lectures the case of Finney (*Annals of Surgery*, July, 1900), and cases of Moynihan, Christy Wilson, Littlewood (additional), Musser and Wharton, Maunsell, Selby, Hume, Moore, and Kellock (*Lancet*, 1900). The total number is 486. Among these were 227 recoveries and 259 deaths, equivalent to a recovery of 44.6 per cent. In the statistics of Tinker (*Philadelphia Medical Journal*, February, 1900), it is shown that during the three previous years, of all cases recorded, 83.78 per cent. had recovered after operation. This estimate is altogether too sanguine.

We consider that, taking the early cases with the late, the good with the bad, a percentage recovery of 40 to 50 is probably the mean.

The following example of successful operation for perforating gastric ulcer may well be quoted, for the patient has since been frequently in attendance upon our surgical cases :

PERFORATING GASTRIC ULCER. OPERATION; RECOVERY.

On May 16, 1897, one of us (Mayo Robson) was asked by Dr. F. H. Mayo to see Miss —, a nurse, aged twenty-four, who, while nursing an elderly lady, was suddenly seized with acute pain in the upper abdominal region without any preliminary symptoms except indigestion, to which she had been subject for some years. Her symptoms were very acute, and within a few hours her abdomen became distended, and there was evidence of fluid in the flanks and in the pelvis. The attack came on immediately after breakfast, when the stomach was full of tea, bread-and-butter, etc.

Operation at 10 p.m., sixteen hours after rupture. Chronic ulcer with perforation the size of a sixpence found near lesser curvature on the anterior surface near the cardiac orifice.

Edges of ulcer refreshed and brought together by sutures; omental graft applied.

Lavage of abdomen with hot saline solution. Suprapubic drainage for several days.

Recovery delayed by an attack of left-sided pleurisy, but ultimately perfect, and she is now and has since been quite well, and has performed her duties as a nurse ever since her recovery.

Perigastric Abscess.

Perigastric abscesses result chiefly from perforating ulcers of the stomach. They may in occasional examples be due to causes originating elsewhere than in the stomach, but such matters do not now concern us.

Ulceration of the stomach leading to perigastric abscess may be of varying degrees of activity. In by far the great majority the ulcerative process has been dilatory, and has

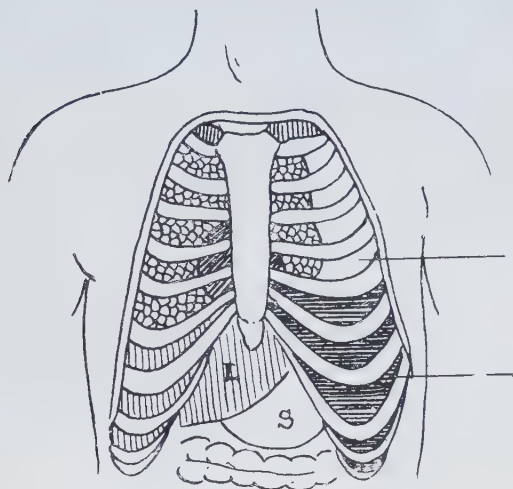


FIG. 36.—PYOPNEUMOTHORAX.

permitted the formation of limiting adhesions; but acute perforation, subacute perforation, and acute perforation operated upon but imperfectly drained, may all give rise to localized abscess.

Perigastric abscesses so arising may have any conceivable relation to the stomach, and may vary considerably in intensity and acuteness. In a minority of cases a circumscribed swelling results, situated most commonly in the left hypochondriac region, or to the left of the middle line, in the epigastrium. As such an abscess slowly enlarges, it may soften the skin and cause it to break down, or rupture may take place into one of the hollow viscera in the abdomen,

or through the diaphragm into the pleural or pericardial cavities.

Owing to the frequency with which perforating ulcers of the stomach are found in definitely localized situations, the abscesses therefrom resulting are localized also in well-recognised areas. The commonest of all positions is beneath the diaphragm, when a **subphrenic abscess**—the ‘pyopneumothorax subphrenicus’ of Leyden—forms. In 179 cases of subphrenic abscess collected by Maydl, 20 per cent. were due to perforation ulcers of stomach and duodenum. The clinical and pathological conditions resulting from subphrenic abscess vary so widely that it is almost impossible to present a clearly-defined symptom group as characteristic of the condition. Godlee (*British Medical Journal*, 1900) says: ‘Think only of such a case as that of a very chronic ulcer of the stomach which has caused extensive adhesions between the viscus and the diaphragm; an abscess may form amongst these adhesions, and burrow about by complicated and narrow tracks until it points perhaps through an intercostal space. Then contrast it with one in which a sudden perforation of a stomach ulcer has occurred, but in which the suppuration is to some extent localized and contains air. It is difficult to trace a family resemblance between these two conditions.’

A subphrenic abscess may be defined as any collection of pus, or gas and pus, which as a whole or in part intervenes between the diaphragm and the structures normally in contact with it. Such abscesses are anterior, resulting from perforation of the anterior wall, and posterior.

Anterior abscesses may form between the right lobe of the liver and diaphragm, to the right of the falciform ligament, or between the left lobe and the diaphragm, to the left of the falciform ligament. The lower boundary in both cases is formed by adventitious adhesions, the result of a massive outpouring of lymph.

Posterior abscesses are contained within the limits of the lesser sac of peritoneum; or, having caused adhesion of the opposing layers of the sac, pus may accumulate in the retro-peritoneal tissue.

Symptoms.

The following account may be held to portray with general accuracy an average case of this kind. At the first there are the warnings of chronic perforation: Pain sudden and sharp, faintness, short and hurried and painful breathing. Tenderness is noticed on the upper part of the abdomen, with irregular, but generally constant, elevations of temperature, and occasionally rigors. The case may now assume the aspect of an acute thoracic condition, and pleurisy, pericarditis, or empyema, may develop and speedily terminate

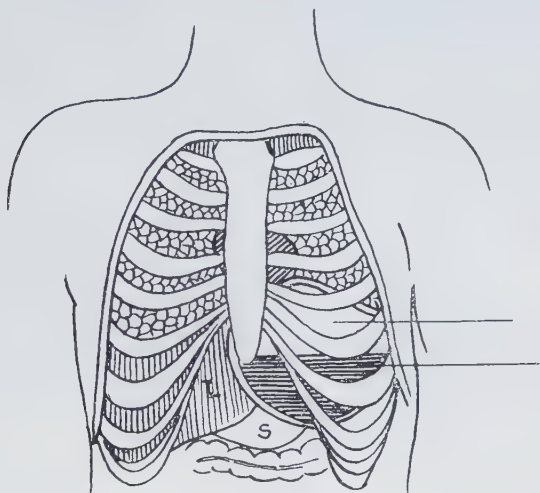


FIG. 37.—‘PYOPNEUMOTHORAX SUBPHRENICUS’: SUBPHRENIC ABSCESS

the patient's life. In the absence of these complications, the symptoms may quietly continue. There will be occasional vomiting, frequent attacks of coughing; dyspnoea will be persistent, and at times distressing; there will be loss of flesh, sweating at night, and all the symptoms of a persisting septic absorption. The pus, gradually increasing in quantity, collects, and alone, or mixed with gas, bulges outwards the lower part of the chest, and pushes upward the wing of the diaphragm. So the heart may be tilted, and its apex beat felt a couple of inches higher than the normal. The lung also is compressed, and the percussion-note over it may be

dulled. The resemblance to a pleuritic effusion may be striking and misleading, but the following points should enable a distinction to be made: (1) The movements of the chest are not impaired on the affected side; (2) the upper limit of dulness is not so sharply defined; and (3) breath-sounds may be heard below the level of the dulness, and if a

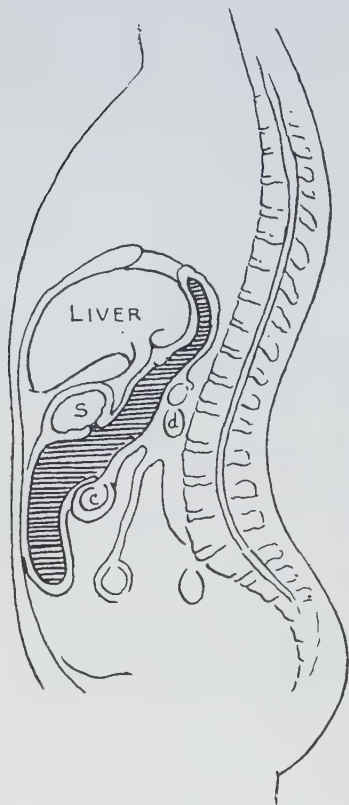


FIG. 38.—POSTERIOR PERIGASTRIC ABSCESS.

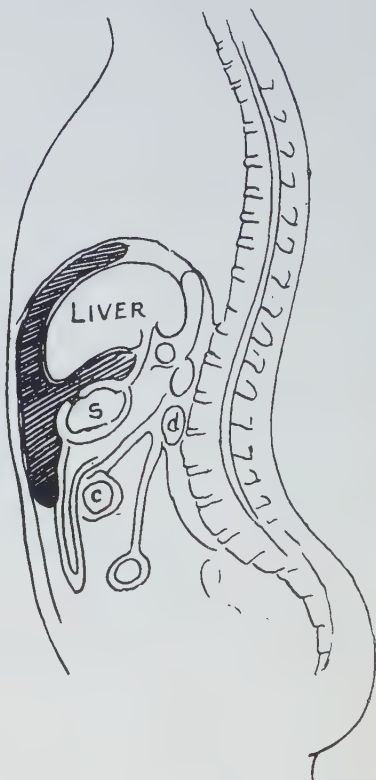


FIG. 39.—ANTERIOR PERIGASTRIC ABSCESS.

deep inspiration be made, the line at which the breath-sounds and vocal resonance are heard, and at which vocal fremitus is felt, is distinctly lowered. (See Figs. 36 and 37.)

The 'diaphragm phenomenon,' to which much attention has been paid, is the existence of a shallow depression which moves with respiration and crosses the intercostal spaces of

the left side as the diaphragm ascends and descends. On palpation of the upper region of the abdomen a collection of fluid may be felt. Greig Smith drew especial attention to the significance of a line or band of induration and resistance, felt through the abdominal wall, moving with respiration. This band is due to the presence of adhesions which limit the abscess cavity below. In the assured absence of tubercular peritonitis, Greig Smith believed this sign to be pathognomonic of subphrenic abscess. When gas is present in the cavity, a tympanitic note will be obtained over the front of the left side of the chest, extending as high up as the fourth rib, or even higher, the whole cardiac area being resonant. On auscultation the vesicular murmur will be heard in the upper part of the chest; below the fourth rib, or thereabouts, there will be amphoric breathing. At the upper part of the abdomen metallic tinkling can be heard, and a loud succussion splash is produced by jerky movements of the body. Over the area of hyper-resonance the *bruit d'airain* may be heard. When the perforation is on the posterior wall of the stomach, the lesser sac of the peritoneum may be filled with the extravasated contents. Pus rapidly forms, and the foramen of Winslow is closed by plastic adhesions. A case of this kind is recorded by Chiari (*Wien. Med. Woch.*, 1876) in which the pancreas, sequestered by the inflammatory process, floated in the pus of the abscess cavity. In such a case physical signs may be wholly lacking, or a tender swelling may be noticed in the umbilical region and lower epigastric, which is dull on deep percussion, and has a varying area of resonance over it. The extremely foetid contents of such an abscess may be vomited, and in the vomit may be recognised shreds of dead tissue.

The abscess, after its definite localization and its hemming in by adhesions, may assume an acuter aspect and burrow upwards or downwards, bursting into the lung, into the pleura (causing pyo-pneumothorax), into the pericardium, or, rarely, into any of the hollow viscera of the abdomen. Surface perforation is occasionally seen, the abscess pointing and bursting through the abdominal or thoracic walls. In this manner the gastric fistulæ, internal or external, are

formed. If a retroperitoneal abscess form, the pus may burrow widely, and an abscess may point in the loin, or groin, or anterior abdominal wall, as in the following :

RETROPERITONEAL ABSCESS DUE TO CHRONIC GASTRIC ULCER.

One of us, Mayo Robson, saw a case in August, 1899, in a woman of thirty-three in which there was an abscess in the retroperitoneal cellular tissue coming after a protracted illness, accompanied by digestive disturbances and occasional vomiting.

The abscess certainly communicated with the stomach, as, when it was opened and drained in the left iliac region, pus of the same odour and the same character in every respect was vomited. At the same time, there was dulness over the lower part of the thorax on the left side, and some pleurisy, though the fluid in the pleural cavity cannot have been pus, as it gradually disappeared after the abscess was drained.

The patient improved very much after the drainage of the abscess, and in about six weeks the tube was left out.

The patient died on the eighth week, when apparently doing well, she having been seen only an hour before death, which occurred from sudden heart failure.

Unfortunately, an autopsy could not be obtained, so that there must necessarily be a doubt as to whether the abscess was dependent on chronic ulcer perforating the stomach gradually after adhesions had formed between the peritoneal layers in the lesser sac, or whether the abscess burst into the stomach by ulceration from without.

The diagram shows the course of the pus in this case to have been similar to that of a duodenal ulcer bursting posteriorly into the retroperitoneal tissues, only in this case it was on the left side.

A perigastric abscess the result of a gastric ulcer may burst secondarily in the stomach, as is exemplified in the following :

CHRONIC GASTRIC ULCER; ABSCESS OF PANCREAS BURSTING INTO STOMACH; VOMITING; IMPENDING DEATH. POSTERIOR GASTRO-ENTEROSTOMY.

On November 1, 1900, one of us (Mayo Robson) was asked by Dr. Mercer, of Bradford, to see Mr. R., who was extremely ill and supposed to be suffering from pancreatic disease.

On arrival we found the patient, aged thirty-five, extremely emaciated, lying in a typhoid condition, vomiting extremely offen-

sive, dark-coloured pus and mucus mixed with blood. He was extremely feeble and had a rapid pulse. A tumour could be felt above the umbilicus, which was tender to pressure. On distending the stomach with CO₂, great pain was produced, and vomiting followed. The stomach was found to be dilated, reaching on the left side to the level of the umbilicus. There had been an elevated temperature for a week or two, but this had become subnormal after the vomiting of pus. Pain after food and indigestion had existed for some months, during which time there had been steady loss of flesh; but recently, especially during the past month, the wasting had been very considerable. There was a little sugar in the urine and a trace of albumin, and the fæces contained free fat. No medicine had done any good, either in relief of the vomiting or in controlling the horrible odour which permeated the whole house. A diagnosis of chronic gastric ulcer of the posterior wall of the stomach, with secondary ulcerative pancreatitis and abscess of the pancreas, was made, and gastro-enterostomy proposed as the only means likely to produce any chance of relief, but even that seemed almost hopeless. He was removed to a surgical home by ambulance, and the stomach was washed out carefully by my colleague, Dr. Stevens. As showing the nature of the stomach contents, both the attendant nurses were made sick by the smell of the material evacuated by the tube.

On November 18, after enveloping the patient in cotton-wool and subcutaneously administering strychnine, posterior gastro-enterostomy was performed, a bone bobbin being used. The tumour felt before operation was found to be formed by stomach and pancreas firmly fixed together towards the pyloric end, but leaving the dilated portion free at the cardiac end of the stomach, so that no difficulty was found in doing a satisfactory operation, which was completed in twenty-five minutes. Saline subcutaneous injections and rectal injections were given and strychnine was freely administered, but for two days we had a great fight with death, apparently due to poisoning from the foul stomach contents. Hot water was freely given to induce vomiting on the second day, as the patient could not bear the stomach-tube being used. This gave relief, and afterwards progress to recovery was uninterrupted. He rapidly gained strength and put on flesh, returning home in five weeks after operation. His friends, who had despaired of his recovery, were astonished to find him so well. In April he was in such good health that he married.

Treatment.

The only treatment that can be counted upon to do good in cases of subphrenic abscess is incision, with subsequent drainage. There are unquestioned cases of abscess which recover spontaneously, either from the rupture of the abscess cavity in one of the directions already mentioned or from gradual drying up of the contents. The most exemplary instance of this which we have met with is the following :

SYMPTOMS OF PERFORATION OF GASTRIC ULCER, WITH SIGNS OF LEFT SUBPHRENIC ABSCESS AND PERITONITIS. RECOVERY WITHOUT OPERATION.

Early in 1900 one of us (Mayo Robson) was asked to see a young lady of twenty-one, with Dr. H. She had been anæmic for several years, and had for some months shown signs of gastric ulcer. One evening during dinner, at which she apparently had not taken any food, she was seized with acute pain in the upper abdominal region, and became faint and extremely ill. She was put to bed immediately, and all food by the mouth was stopped, as rupture of a gastric ulcer was suspected.

When we saw her later there were well-marked signs of peritonitis in the upper abdomen, and the recti were tense, especially the left. The lower ribs were fixed and rigid, and there was a distinct prominence beneath the left costal margin. From the seventh rib downwards there was an entire absence of breath-sounds, and percussion showed hyper-resonance with tension, as if gas were compressed in a limited space. The temperature had been raised, but was subsiding, and as the pulse, which had been rapid, was quieting down, we decided to wait and watch the case, feeding by the bowel and keeping the stomach free from food. Recovery was gradual, but complete, and we hear that the patient is now well.

According to Lang, who has collected 176 cases from surgical literature, after operation the percentage of recoveries is 47·9 per cent., and of the recoveries without operation 12·3 per cent. Beck found 6 spontaneous recoveries in 146 cases. The incision should be made, as a rule, over the most prominent point of the abscess. This may be in the abdominal wall, below the costal margin in front, or behind in the lumbar region, or in the thoracic wall.

The incision is carefully made into the abscess cavity, the

contents emptied, and the cavity flushed with sterile solution, or, and this is better, carefully sponged until as clean as possible. Flushing may lead to rupture of protective adhesions, and if adopted should be carefully supervised. If, after so cleansing the cavity, the ulcer which has perforated can be recognised, and is easily accessible, it may be stitched up. Drainage by means of large tubes with gauze wicks is adopted.

When the thoracic wall has to be incised, the pleural cavity is opened by resection of one or more ribs. The parietal and diaphragmatic layers of the pleura are then stitched together and the diaphragm is incised. Drainage is adopted in the manner above described.

SUBPHRENIC ABSCESS DISCHARGING THROUGH LUNG. DRAINAGE; RECOVERY.

Miss Isabel P., aged twenty-four, was sent to Mayo Robson on June 1, 1900, by Dr. Densham, of Stockton, with the history of three years' indigestion and vomiting, ending in perforation of gastric ulcer and peritonitis in November, 1899. She was extremely ill and for many weeks in a dangerous state, but gradually improved. A month after the perforation there were signs of suppuration with some dulness at the base of the left chest, and two months after the perforation an abscess burst through the left lung and a large quantity of offensive pus was coughed up, and continued to be coughed up, until she reached the Leeds Infirmary, where the purulent expectorations measured about half a pint daily. She was then extremely feeble and suffering from a hectic temperature. There was dulness over the lower part of the left lung. On examining the offensive material expectorated, muscular fibres were found in it, but no elastic tissue, thus showing the source of the pus.

An exploring needle used in the ninth left intercostal space found pus. A portion of the ninth rib was therefore dissected, and an incision made through the thoracic wall and diaphragm into the abscess cavity, which was freely drained. Recovery was rapid, and the foul expectoration ceased at once.

The opening leading from the stomach to the abscess closed spontaneously, and the tube was left out in about a month, after which the wound closed. She was sent to a convalescent home, and returned home in three months well.

The following are the recorded results of perforation of the stomach the result of ulceration :

1. **Acute Perforation.**—Acute septic peritonitis; secondarily, perigastric or subphrenic abscess.

2. **Chronic Perforation.**—The ulcer may be supported on the outer side by adhesions to—

Omentum,

Abdominal wall, leading to **external gastric fistula**,

Diaphragm,

Solid viscera, liver, spleen, pancreas, lymphatic glands.

The ulcer may perforate into the lesser sac, the foramen of Winslow being closed.

The ulcer may perforate, a perigastric abscess forming and bursting into—

Pleura,

Pericardium,

Heart,

Bronchus,

Mediastinum ;

or into hollow viscera, forming **internal gastric fistula** :

Intestine, large or small,

Stomach,

Gall-bladder,

Common bile-duct,

Pancreatic duct ;

or into peritoneum or subperitoneal tissue, causing emphysema of subcutaneous or subperitoneal tissue, or leading to the occurrence of gas in the veins and arteries (Jürgensen).

(The gas found in general emphysema is said to consist chiefly of hydrogen, and to burn with a blue flame.)

CHAPTER XI

THE COMPLICATIONS OF GASTRIC ULCER (*continued*)

Hour-glass Stomach.

By 'hour-glass' stomach is understood that condition of the stomach in which the viscus is divided into two cavities. The cavities are generally of unequal size. The terms 'hour-glass contraction of the stomach,' 'double stomach,' and 'bilocular stomach' have been adopted by various authors.

Hour-glass stomach may be described as **congenital** and **acquired**.

Congenital hour-glass stomach is commonly asserted to be the more frequent variety. Thus Fenwick writes: 'In about 45 per cent. of the cases which have been recorded neither ulcer nor scar could be detected in the stomach, while in the great majority of the cases where an ulcer was present it was obviously of more recent formation than the stricture.' And again: 'That the deformity is a rare result of ulceration is proved by the fact that only one case of the kind is mentioned in the records of the London Hospital for forty years, whereas several instances of the congenital form of the disease were encountered during the same period of time.' Similar statements have been made by Carrington, Roger Williams, Hirsch, and, in fact, every writer who has dealt with the subject.

We consider that the evidence of the existence of hour-glass stomach as a congenital deformity is insufficient to be convincing. It cannot be denied that congenital cases may exist, for as a fact they are not improbable when we

contemplate the circumstances in congenital stenosis of the pylorus; but we are sceptical that any of the recorded cases of congenital deformity are in reality of such an origin. It is a noteworthy fact that in many of the so-called congenital cases, if not in all, ulceration was present in some part of the stomach. This is true of Carrington's cases, of Hudson's, Saundby's, Williams's, and Hirsch's. In Watson's first case it is said that the mucous membrane at the point of constriction and on each side of it 'is thrown into abnormally heavy ridges,' which implies that a process of narrowing from a larger bulk has here occurred. In certain of the museum

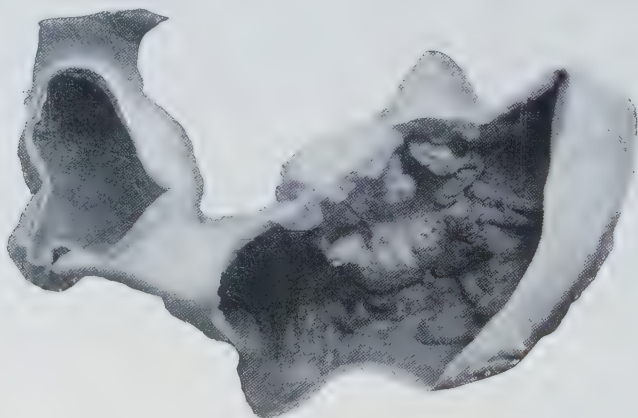


FIG. 40.—HOUR-GLASS STOMACH; PROBABLY CONGENITAL WITH GROWTH ROUND CARDIAC ORIFICE.

(No. 2,416, Royal College of Surgeons' Museum.)

specimens labelled 'congenital' it is quite clear that no adequate examination of the specimen has ever been made. Indeed, such an examination necessitates a so free handling of the specimen as to spoil it entirely for decorative purposes. The simple aspect of a pathological constriction can be most deceptive. One of the cases related below was an exemplary instance of this. The isthmus uniting the cardiac and pyloric cavities was barely the size of one's little finger; it was perfectly soft, smooth, and everywhere supple. There was no trace of any thickening or puckering of the surface. On invaginating a finger into the cavity on each side of the narrowing, no orifice could be felt leading from the one

to the other. To all appearance, no pathological process had ever existed there. On slitting the stricture up, as a preliminary to performing gastropasty, the following condition was found: The passage was equal in diameter to a No. 4 or 5 catheter, most of its circumference was natural in appearance, but at the upper and anterior part was a small dead white area, clearly cicatricial, and from near this there ran, on the pyloric side, vertically down to the opposing



FIG. 41.—CANCER OF ANTERIOR WALL OF THE STOMACH PRODUCING HOUR-GLASS CONTRACTION.

Man, aged sixty, with four years' history of vomiting, and other signs of ulcer. This is an example of 'ulcus carcinomatosum.' (No. 2,408c, Royal College of Surgeons' Museum.)

mucous surface, a column clad completely in mucous membrane, and $\frac{1}{2}$ inch in diameter. The column was removed between two ligatures, and it was then found to be built up of dense fibrous tissue. There was, in fact, a 'bridle stricture' in the stomach. That it was pathological admits of no question, yet nothing short of a division of the stricture could have revealed its inflammatory origin. There can be no doubt

that, if the whole stomach had been obtained from a post-mortem examination, the specimen would have been proclaimed an admirable example of congenital hour-glass stomach.

Hochenegg on a similar case performed the operation of gastro-gastrostomy. No careful examination of the narrow stricture was made, but the case is quoted as an example of 'congenital' deformity. Such a case is quite inadmissible. Doyen's case, referred to in the list, is christened 'congenital.' At the point of narrowing there was an ulcer adherent to the anterior abdominal wall. On separating the adhesions, a gastric fistula was exposed, showing unmistakably that a localized perforation of the ulcer, with anchoring, was responsible for the warping of the stomach.

Williams (*Journ. Anat. and Physiol.*, 1883) describes ten cases of 'congenital contraction of the stomach.' The account of one of the cases is based on the examination of a wax model, of another on the inspection of an 'inflated dried' specimen, and a third on the appearance of a 'dried stuffed' specimen. It is doubtful whether one of the examples can be accepted as an 'hour-glass' stomach. In all the rest pathological conditions, ulceration, puckering, thickening, adhesion to pancreas, were present. It is improbable that any of the stomachs was the seat of a congenital deformity. The same criticism applies to Carington's cases and to Maier's.

The facts that pathological changes producing marked changes in the contour of the stomach may be inconspicuous, that ulceration in association with 'congenital' deformity is not infrequent, and that in many of the examples no purposeful examination of the specimen has been made, warrant us in saying that congenital hour-glass stomach is certainly rare, and not improbably mythical.

In 20 examples of this supposed variety collected by Watson, the stricture was situate in the middle in 7, at the junction of the upper and middle thirds in 3, at the junction of the lower and middle thirds in 4, and was not noted in 6.

Acquired Hour-glass Stomach.

Acquired hour-glass stomach may be caused by—

1. Perigastric adhesions.
2. Ulcer with local perforation and anchoring to the anterior abdominal wall.
3. Circular ulcer, with subsequent cicatricial contraction and induration.
4. Cancer.

1. **Perigastric Adhesions.**—These may be the result of many causes, among them being perforation of a gastric ulcer. The adhesions chiefly concerned in producing the condition may be a thick cord running downwards from the liver, and sharply pressing into the anterior wall of the stomach. In one of Mayo Robson's cases such an adhesion caused the cardiac end of an hour-glass stomach to be itself divided into two, thus forming a 'trifid stomach.'

2. **Ulcer with Local Perforation and Anchoring of the Stomach to the Anterior Abdominal Wall.**—In this form a chronic ulcer of the anterior wall of the stomach makes its way in languid fashion through the coats of the organ. As it nears the serous coat adhesions are formed, binding it to the parietal peritoneum, which solders the base and prevents a general leakage. The stomach being then firmly anchored at this one point, a sagging of the cavity on each side, but chiefly in the cardiac side, occurs, and this, with the cicatricial contraction occurring in the ulcer, results in an hour-glass stomach. Excellent examples of this are referred to below.

Similar cases are recorded by Steffan and Finney.

Cases of general perforation into the peritoneal cavity are recorded by Siewers and W. H. Brown.

3. **Circular Ulcer, with Subsequent Cicatricial Contraction and Induration.**—Such an ulcer extends transversely to the long axis of the stomach, and in its contraction while healing must inevitably cause a high degree of narrowing (see Fig. 32). The simple round ulcer is also fully competent to produce a stricture, though probably not with the same completeness as the former. The conditions found in some of our cases

suggest very forcibly the likelihood of the ulcer having perforated into the general peritoneal cavity.

The stricture may be placed at any part of the stomach; it is generally near to the middle, or rather to the pyloric side of the middle. The calibre of the orifice may vary from that of a No. 4 or No. 5 catheter to that sufficient to allow of the passage of three fingers. The greater curvature is generally puckered up towards the lesser, but the reverse is recorded in one case by Schwarz.



FIG. 42.—CANCER OF THE CARDIAC END OF THE STOMACH CAUSING THE FUNDUS TO BE PARTIALLY SHUT OFF, SO AS TO FORM A LARGE POUCH. (MODIFICATION OF HOUR-GLASS STOMACH.)

From a woman of fifty, who had had symptoms for three years. 'Ulcus carcinomatosum.'

4. **Cancer.**—Cancer of the stomach is a not infrequent cause of hour-glass stomach. In some of the specimens the cancer has clearly been implanted upon a chronic ulcer ('*ulcus carcinomatosum*'). In others, the cancer, originating in a localized area of the stomach, and there producing the constriction of the hour-glass, has in its later growth involved the greater part, or even the whole, of the stomach. The stomach then is thickened in all its coats by a diffuse growth, and the condition described as 'leather-bottle' stomach results.

Symptoms.

The symptoms of hour-glass stomach are oftenest those of dilated stomach supervening upon chronic ulcer of the stomach. In most of the cases recorded a diagnosis of 'dilated stomach' has been made, and in those dealt with surgically operative interference has been undertaken for the relief of supposed pyloric stenosis. In certain cases, however, the symptoms and signs are clear and pointedly characteristic. In four of our cases a confident diagnosis was made thereon.

Two of the most helpful signs were pointed out by Wölfler. They are :

1. These phenomena were observed upon washing out the stomach. The fluid introduced into the stomach seemed to disappear altogether, 'as though it had flowed through a large hole,' and is not returned through the tube. In such a circumstance the fluid passes, it is obvious, from the one compartment to the other.

2. It was further noticed that when the stomach was washed out until the lotion returned clear, a sudden, unlooked-for gush of foul, or even putrid, fluid occurred ; or if, after gentle lavage until the stomach seemed clean, an interval of a few minutes was allowed to elapse, and the tube again passed, foul or dirty fluid at once returned. This is due, doubtless, to the reflux of the contents of the pyloric cavity through the stricture.

Jaworski (*Wien. Klin. Woch.*, 1898) noticed in one instance that, after apparently emptying the stomach by passing the tube, a splashing sound could still be obtained by palpation over the gastric area. The pyloric cavity, which is not drained by the stomach-tube, causes this suggestion of dilated stomach. The condition has been appropriately described as 'paradoxical dilatation.'

Eiselsberg remarked in one of his cases, that upon injecting a quantity of fluid into the stomach there was a bulging and distension of the left side of the epigastrium ; after a few moments this gradually sank and subsided, and simultaneously a swelling of the right side of the epigastrium slowly developed.

A sign to which Eiselsberg also called attention in this case was well exhibited in two of our cases. On distending the stomach with CO_2 , the bubbling and gushing of fluid through a narrow chink could be heard with the stethoscope, an observation that was repeated in Watson's case. If the area of gastric resonance be marked out before and after distension, a marked increase, even to doubling, is noticed in the resonance of the cardiac complement, while the pyloric complement may seem to mimic the appearance of a dilated stomach. Investigation in this manner would have revealed this sign very clearly in Pollard's case and in Childe's case, recorded in the list. There can be no risk in distending the stomach with CO_2 , and therefore this method should be adopted in all doubtful cases. It seems not unlikely that the sign will be most helpful in making an accurate diagnosis. In two cases, seen by Schmidt-Monard and Eichhorst, a distinct sulcus separating two dilated cavities was seen on inflation with CO_2 . This appearance was observed in a patient seen in private at separate consultations by both of us. In slighter cases of constriction, a notch may be recognised in the lower margin of the stomach.

The symptoms resulting from a narrowing in the stomach will naturally depend upon the part of the viscus affected. If the contraction be near the pylorus, the cardiac pouch will distend to almost any capacity, and the clinical picture will be that of dilatation of the stomach. If the stricture be placed but a little way from the cardiac, the symptoms will suggest œsophageal obstruction. The differential diagnosis can, however, be achieved by noting the distance which the œsophageal bougie passes. In one case, seen with Dr. Sykes, of Cleckheaton, a correct diagnosis was made, and a seemingly accurate estimate of the capacity of the cardiac complement made by observing the following symptoms: When the patient took a tablespoonful of milk he retained it; if an ounce or two were drunk at a gulp, the greater part was returned. The stomach-tube passed 18 inches without difficulty. On attempting to wash the stomach out, 1 ounce or a little more of fluid passed in, but no more. We administered a seidlitz powder in separate halves. The first half

was retained; on administering the second, the patient was overwhelmed by a gush of foam, which burst from his mouth and nostrils. The diagnosis of hour-glass stomach with a smaller cardiac and a larger pyloric segment was made. At the operation this condition was found; it was the result of malignant disease, which had already caused secondary deposits in the parietal peritoneum and ascites.

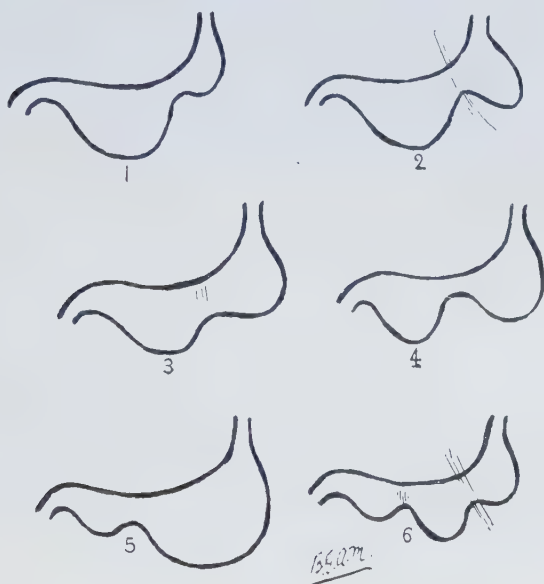


FIG. 43.—TYPES OF HOUR-GLASS STOMACH.

- 1, Constriction near the cardia (simulates œsophageal obstruction); 2, cardiac complement hidden by adhesion (thorough examination of the whole stomach is necessary); 3, constriction with much induration; 4, a narrow channel connects the two pouches; 5, constriction near the pylorus (simulates pyloric obstruction); 6, hour-glass stomach (the cardiac complement subdivided by an adhesion), 'trifold stomach.'

The characteristic signs, then, are :

1. Disappearance of fluid introduced through the stomach tube, 'as though it had flowed through a hole' (Wölfler).
2. After cleansing of the stomach by lavage, a sudden gush of putrid, sour, ill-digested food, etc. (Wölfler).
3. 'Paradoxical dilatation'; succussion splash in pyloric cavity after siphonage of the cardiac (Jaworski).

4. Distension of cardiac loculus, its gradual subsidence, and concomitantly the distension of the pyloric loculus (Eiselsberg).

5. During this period a gurgling, forcing sound heard over or near the middle of the stomach (Eiselsberg).

6. On distension with CO_2 , a large increase, even to a doubling, in the thoracic area, tympanitic on percussion, and a slight distension, clearly demarcated, of the pyloric loculus.

7. Rarely a sulcus may be seen on inflating with CO_2 .

Treatment.

The following operations have been practised in cases of hour-glass stomach:

1. Gastroplasty with or without resection of the ulcer.
2. Gastro-gastrostomy, or gastro-anastomosis.
3. Gastro-enterostomy.
4. Partial gastrectomy.

Frequently, owing to the existence of adhesions, gastrolysis has to be performed in addition to the operations mentioned.

The choice of an operation will be determined by the conditions found at the operation. It is essential that a careful and complete examination of the whole stomach be made before the curative procedure is adopted. For in some of the cases related below it will be noticed that the lack of adequate and precise knowledge has led to futile measures and fatal results.

If the constriction be near the middle of the stomach, if there be little induration and no active ulceration, and if the pylorus be free, a gastroplasty will prove successful.

If the constriction be in any part of the middle third or half of the stomach, if the pouches on each side are 'sagging' and free from adhesion, and if the pylorus is free, a gastro-gastrostomy will suffice to effect a cure.

If, however, the stomach narrowing be associated with pyloric stenosis, the existence of which must be suspected if the pyloric segment is dilated also, no single operation will suffice. A gastroplasty and a pyloroplasty, or a gastroplasty and a posterior gastro-jejunostomy, must both be performed.

It is possible, in some cases, such as that of Schwarz, where the lesser curvature is dragged down to the greater, that the incision dividing the constriction to the stomach might be utilized for the purposes of an anterior gastro-jejunostomy.

If on separating parietal adhesions a gastric fistula be found, as in Doyen's case and in two of ours, the ulcer may

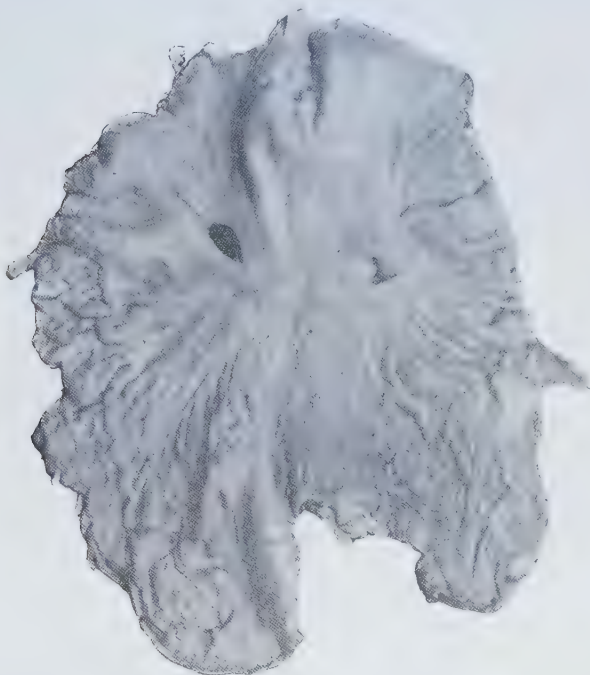


FIG. 44.—STOMACH SHOWING TWO PERFORATING ULCERS: ONE ON THE ANTERIOR, ONE ON THE POSTERIOR, SURFACE.

be excised, or its edges refreshed, and a gastroplasty be performed.

If the constriction be due to new growth, a partial or complete gastrectomy may be performed. If these prove not feasible, a palliative jejunostomy may be necessary.

Various operators have expressed individual preference for certain methods. Thus, Eiselsberg prefers gastro-enterostomy. He has performed operations upon eight patients;

three of the patients died as a result of the operation, and of the five survivors one suffered from a recurrence of the symptoms at the end of nine months. Eiselsberg objects to gastroplasty that recurrence of the stenosis is probable. The same objection has been brought by Berg and others against pyloroplasty. The probability is that while the process of ulceration is still active, or induration or adhesions are present, it is unwise to perform a gastro- or pyloro-plasty.

It is especially important to observe the condition of the pyloric portion of the stomach. If the isthmus be a narrow one, the pyloric segment should be small and empty. If the pyloric cavity be dilated, as is expressly noted in Jaboulay's case and in Watson Cheyne's, there is a strong presumption in favour of the existence of a pyloric narrowing. If such narrowing be present and a gastroplasty alone be performed, the operation, though 'successful' so far as recovery is concerned, cannot be expected to relieve the patient of all disabilities, and a second operation may be imperative.

1. **Gastroplasty** is an adaptation to the body of the stomach of Heineke's operation for pyloric stenosis. It was performed by Bardeleben in 1889, Kruckenberg in 1892, and later by Zeller and Doyen and others.

A transverse incision, 4 inches in length at least, is made, dividing the stricture. The incision is then stitched up vertically. Two continuous layers of sutures are introduced—one for the mucous membrane only, or all the coats, and the other for the serous or subserous coats alone.

One of us (Mayo Robson) employs a large bone bobbin, over which the sutures are applied.

2. **Gastro-gastrostomy**, or **gastro-anastomosis**, was first performed by Wölfler in 1894. The incisions made into the dependent pouches on each side of the constriction were vertical, and 7 centimetres in length. An adequate anastomosis between the two halves was thus made.

Sedgwick Watson, in 1895, successfully performed gastro-anastomosis in a different manner. The incisions in the two segments of the stomach were transverse. The pyloric portion of the viscus was folded over the cardiac, with the constricting

isthmus as a hinge, and the two stitched together with an elliptical line of sutures before being opened. The anastomosis was then made by incising the wall of the pyloric compartment, which now lay anterior and through the opposite surface, making the anastomosis. This method is unnecessarily cumbersome, and possesses no potential advantages over Wölfler's method.

3. **Gastro-enterostomy** is not generally applicable, for if the pyloric pouch be united to the jejunum, as in Pollard's case and in Childe's, the operation will avail nothing; for the disability is due to the fact that food cannot enter the pyloric portion of the stomach. If the cardiac complement be united to the intestine, the pyloric pouch is undrained, and symptoms will persist and necessitate a second operation, as in Tuffier's case. Weir and Foote (*Medical News*, 1896) advise that a double anastomosis between both pouches and the jejunum be made at the same operation, a method that would probably prove satisfactory.

4. **Partial Gastrectomy.**—In cases of cancer always, and in certain cases of simple disease, a partial gastrectomy may be the operation of choice. In cancer a wide excision should be made; in simple disease a removal of the constriction will suffice. In both an end-to-end suture is desirable.

A further description of these procedures will be found in the chapter on Operations.

The following is a complete list of all recorded cases:

CASE 1: BARDELEBEN, 1889.—Hour-glass stomach. Gastroplasty. Recovery and relief. (Klemperer, *Berliner Klinische Wochenschrift*, 1889.)

CASE 2: KRUCKENBERG, 1892.—Thickened scar on the anterior surface. Gastroplasty with excision of ulcer. Recovery with complete relief. (Schmidt-Monard, *Münchener Medicinische Wochenschrift*, 1893, No. 19.)

CASE 3: ZELLER, 1893.—Hour-glass stomach, the result of healed ulcer; cicatrix. Resection of cicatrix of healed ulcer. Death from septic peritonitis, result of perforation of another ulcer. (*Centralblatt für Chirurgie*, 1894.)

CASE 4: DOYEN, 1893.—Constriction at middle of stomach, due to ulcer adherent to the anterior abdominal wall. On separating adhesions a gastric fistula was found. Scraping of ulcer and

inversion; gastropasty. (This case is called congenital.) Recovery. ('*Traitement Chirurgical des Affections de l'Estomac*,' Paris, 1895, p. 308.)

CASE 5: WÖFLER, 1894.—Stomach constricted into two equal portions by scar of ulcer. Gastro-gastrostomy. Recovery; at the end of three months quite well, and had gained 9 kilogrammes in weight. (*Beiträge zur Klinischen Chirurgie*, 1895, No. 13.)

CASE 6: EISELSBERG, 1894.—Cicatrix of old ulcer. Gastro-gastrostomy. Death; sutures introduced into indurated area had cut through. Septic peritonitis. (*Archiv für Klinische Chirurgie*, Band 1.)

CASE 7: WATSON, 1895.—Constriction at junction of middle and lower thirds, the result of old ulcer. Gastro-gastrostomy. Recovery; complete relief; gained 42 pounds in six months. (*Boston Medical and Surgical Journal*, 1896.)

CASE 8: LAUENSTEIN, 1895.—Constriction due to cicatrix, from which adhesions ran to liver. Gastro-gastrostomy. Recovery; in three months gained 35 pounds. (*Münchener Medicinische Wochenschrift*, 1896, No. 43.)

CASE 9: LANGENBUCH, 1896.—Hour-glass stomach. Gastropasty. Recovery without relief. (*Berliner Klinische Wochenschrift*, 1896; *Thèse de Lyons*, 1896.)

CASE 10: VAN NOORDEN, 1896.—Perforation of the stomach by ulcer. Establishment of fistula. Death on fifty-sixth day. (*Münchener Medicinische Wochenschrift*, 1896.)

CASE 11: HOFMEISTER, 1896.—Ulcer and cicatrix. Excision of ulcers. Gastropasty. Recovery. (*Beiträge zur Klinischen Chirurgie*, 1896.)

CASE 12: SCHWARZ, 1896.—Constriction near middle, due to adhesions extending to diaphragm, liver, etc. The lesser curvature was drawn down to greater. Gastro-gastrostomy; gastrolisis at second operation. Symptoms not improved until after second operation. (*Wiener Klinische Wochenschrift*, June, 1896.)

CASE 13: EISELSBERG, 1896.—Large ulcer on greater curvature, near fundus; adhesions to anterior abdominal wall. Gastropasty. Recovery; return of symptoms after nine months. (*Archiv für Klinische Chirurgie*, 1899.)

CASE 14: JABOULAY, 1896.—Constriction very narrow in pyloric third of stomach. Both cavities dilated. Cicatrix near lesser curvature; adhesions to the left lobe of the liver. Gastropasty. Recovery; relief of symptoms. (*Archives Provinciales de Chirurgie*, 1896.)

CASE 15: TUFFIER, 1897.—Hour-glass stomach; both cavities dilated. Gastro-enterostomy between cardiac pouch and intestine; symptoms not wholly relieved. At a second operation a

gastro-enterostomy between pyloric pouch and intestine. Recovery from both operations; complete relief after the second. (*Bulletin et Mémoire de la Société de Chirurgie*, 1897.)

CASE 16: WATSON CHEYNE, 1897.—Constriction permitting passage of a crow-quill only in middle of the stomach. Both parts of the stomach dilated. Gastroplasty. Recovery. (*Lancet*, March 19, 1898, p. 785.)

CASE 17: EISELSBERG, 1898.—Constriction admitting little finger in pyloric third of organ; adhesions to liver and pancreas; perigastric abscess. Gastroplasty. Death in ten hours. (*Archiv für Klinische Chirurgie*, Band lix.)

CASE 18: EISELSBERG, 1898.—Constriction in middle of the stomach; adhesions to posterior abdominal wall and liver, and erosion of pancreas by open ulcer. Gastroplasty; jejunostomy. Death in twelve hours. (*Archiv für Klinische Chirurgie*, Band lix.)

CASE 19: EISELSBERG, 1898.—Constriction admitting the little finger in the pyloric third of the stomach. Gastroplasty; twelve months later gastro-enterostomy. Recovery from both operations. Symptoms recurred nine months after the first operation. (*Archiv für Klinische Chirurgie*, Band lix.)

CASE 20: EISELSBERG, 1898.—Circular constriction nearer cardiac than pylorus. Three operations—two gastro-plastic, one gastro-gastrostomy; intervals were four, nine and two months. Recovery from operations, but recurrence of symptoms after all. (*Archiv für Klinische Chirurgie*, Band lix.)

CASE 21: EISELSBERG, 1899.—Constriction admitting the passage of one finger, due to circular cicatrix and adhesions to liver. Gastroplasty. Recovery with entire relief. (*Archiv für Klinische Chirurgie*, Band lix.)

CASE 22: EISELSBERG, 1899.—Circular constriction nearer cardiac than pylorus; dense mass of adhesions from constricted portion of stomach to liver. Gastro-enterostomy. Recovery and complete relief. (*Archiv für Klinische Chirurgie*, Band lix.)

CASE 23: VON UNGE, 1898.—A circular constriction admitting forefinger 8 centimetres from pylorus. Gastroplasty. Recovery. (*Centralblatt für die Grenzgebiete der Medicin und Chirurgie*, May, 1899.)

CASE 24: VON UNGE, 1898.—A circular constriction admitting forefinger 10 centimetres from pylorus; a mass of adhesions. Gastroplasty. Recovery. (*Centralblatt für die Grenzgebiete der Medicin und Chirurgie*, May, 1899.)

CASE 25: HASTINGS GILFORD, 1898.—Hour-glass stomach; the constriction barely admitted one finger. On the cardiac side of the constriction an ulcer had perforated and formed an adventitious cavity. Gastroplasty. Died one month after operation

from hæmatemesis. The wound in the stomach was partially unhealed at the point of thickest induration. (*Guy's Hospital Reports*, vol. liii., 1898.)

CASE 26: COURMONT, 1898.—Hour-glass stomach. Gastroplasty. Recovered. (Hochenegg, *Wiener Klinische Wochenschrift*, 1898.)

CASE 27: CUMSTON, 1898.—Constriction at the junction of the middle and lower thirds; adhesions to surrounding structures. Gastroplasty. Recovery; well eight months after. (*New York Medical Journal*, 1899.)

CASE 28: HOCHENEGG, 1898.—Constriction at junction of middle and pyloric thirds, admitting little finger; cardiac portion immensely distended. Gastro-gastrostomy. Recovery. (*Wiener Klinische Wochenschrift*, 1898.)

CASE 29: BIER, 1898.—Female, aged fifty-one. Ten years' history of stomach trouble, loss of weight, pain, vomiting; never hæmatemesis. Gastroplasty. Ulcer near lesser curvature; the cardiac pouch much dilated. Recovery.

CASE 30: BIER, 1898.—Female, aged twenty-nine. Stomach troubles since ten years old. Hæmatemesis; constant pain. Stomach dilated to 3 fingers' breadth below umbilicus. Narrowing of pylorus found at operation; gastro-duodenostomy; death. At the post-mortem an hour-glass stomach, the pyloric complement of which had been mistaken for the whole stomach.

CASE 31: BIER, 1898.—Female, aged thirty-nine. Stomach trouble since childhood—vomiting, pain, etc. Above the umbilicus an area of resistance and tenderness; the greater curvature descends 1 inch below the umbilicus. At the operation a tumour the size of a hen's egg found in the middle of the stomach adherent to the anterior abdominal wall; tumour excised, and found to consist of induration round a chronic ulcer. Gastroplasty. Recovery.

CASE 32: BIER, 1898.—Male, aged fifty-six. Since twelve and a half years of age stomach trouble. In the epigastrium a tumour the size of a man's fist; found on exploration to be due to adhesion of stomach and œdema of abdominal wall. An ulcer in anterior wall between curvatures, which in its contraction had caused an hour-glass stomach. Excision of ulcer; gastroplasty. Death. (Cases 29 to 32 are related in a thesis by Eduard Asbeck. *Vier Fälle von Sanduhrmagen*, Kiel, 1898.)

CASE 33: MORSE.—Male, aged sixty. Pain in stomach for twenty years. Hour-glass stomach with large cardiac pouch; adhesions between liver and constriction. Gastrolisis; gastroplasty. Recovery. (*Lancet*, May, 1899.)

CASE 34: MACGILLIVRAY.—Woman, aged twenty-four. For

several years continuous indigestion, severe pain and vomiting, once hæmatemesis. Sudden seizure, pain and collapse. On opening abdomen an hour-glass stomach, with perforation of an ulcer near lesser curvature. Gastroplasty. Recovery. (*Scottish Medical and Surgical Journal*, July, 1899.)

CASE 35: WATSON, 1900.—Perforating ulcer, with perigastric abscess and a mass of adhesions at the junction of the middle and lower thirds; stricture admitting one finger. Ulcer inverted and sutured; gastrolysis. Death on fourth day from general septic peritonitis. (*Annals of Surgery*, July, 1900.)

CASE 36: KLEIN, 1900.—Hour-glass stomach, the result of cicatricial contraction following the drinking of corrosive fluid. Gastro-duodenostomy. Recovery and entire relief. (*Wiener Klinische Rundschau*.)

CASE 37: SIDNEY MARTIN AND BILTON POLLARD, 1900.—Hour-glass contraction and stenosis of pylorus. At the first constriction there was a small perigastric abscess. The second compartment was much larger than the first. Pylorus very stenosed, and peripyloric abscess found, due to perforating ulcer just beyond pylorus. Gastro-jejunostomy. The second compartment of the stomach united to the intestine. Death on fifth day. (*British Medical Journal*, vol. ii., 1900.)

CASE 38: CHILDE, 1901.—Hour-glass stomach. The cardiac portion lay under cover of the ribs, and was not noticed until the necropsy. The pyloric portion was supposed to be the whole stomach, and 'was not abnormally large.' Gastro-enterostomy between pyloric segment and jejunum. Death on fifth day. (*British Medical Journal*, vol. ii., 1901.)

The following is a complete list of all our cases :

HOURLASS STOMACH DUE TO SIMPLE DISEASE.

CASE 1.—Mrs. S. W. Seen at infirmary. Nine years ago pain and vomiting. Three years ago pain and vomiting. One year ago pain and vomiting. Never free from pain since last attack. Then symptoms of perforation. Epigastrium very tender. Hour-glass stomach. Adhesions to abdominal wall, and on separation perforation found. Operation May 18, 1899 (gastroplasty). Bone bobbin. Constriction in centre of stomach. June 26, weight 6 stones 7 pounds; July 29, 7 stones 2 pounds.

CASE 2.—Miss P., aged thirty. Seen with Dr. Duncan, Clay Cross. Fifteen years' history of ulcer. Hæmatemesis ten years before. Patient an invalid. Stomach trifold. Operation June 6, 1899 (gastroplasty—bone bobbin—and separation of adhesions). Recovery. August 6, 1899, was well, and had gained 2 stones.

CASE 3.—Mr. E. M., aged twenty-three. Seen at infirmary. Two years' pain and vomiting after food. Has lost 2 stones in weight. Tender epigastrium. Dilatation of stomach. Splashing. Operation July 20, 1899 (gastroplasty). Bone bobbin. Constriction 2 inches from pylorus. Recovery. Out-patient August 24.

CASE 4.—Miss D., aged forty-eight. Seen with Dr. Hindle, Askern. Indigestion and flatulency for twenty years. Free hæmatemesis two years before. Great loss of flesh. Dilatation. Tenderness. Operation July 28, 1899 (gastroplasty). Bone bobbin. Extreme contraction one-third distance from pylorus. Stricture would just admit tip of little finger. Recovery. Improvement and increase of weight November 1. See Gastro-enterostomy for relapse.

CASE 5.—Mrs. R. D., aged thirty-nine. Seen with Dr. Bailey, Horsforth. Hour-glass stomach, the narrow constriction being near the middle of the stomach, and adherent to the anterior abdominal wall over an area equal to a crown piece. On each side of this the stomach dilated, and seemed to be anchored by the adhesion. On separating the stomach from the abdominal wall, an opening into the viscus was exposed, and stomach contents escaped. This opening was enlarged transversely, and the wound and fistula stitched up vertically. An omental graft was brought to cover in the sutured area, in order to guard against future anchoring. Ten years ago an illness characterized by profound anæmia. Seven months ago clear symptoms of ulcer of the stomach, but neither then nor at any time any acute illness suggestive of perforation. Now vomits after all ordinary food, and more often than not even after small quantities of fluid food. Pain after food is exceedingly severe. On examination of abdomen a dilated stomach can be felt. At a point a little to the left of the middle line, and slightly below the ensiform cartilage, is an area 2 inches in diameter, which is markedly tender, and offers increased resistance on palpation. This area was found, at the operation, to correspond precisely with the area of stomach adhesion. Patient has lost weight, and deteriorated seriously in general health during the last few months. Recovery. For a month after the operation pain at times and loss of appetite. Since then has been free from pain and in excellent health. Appetite and digestion good.

CASE 6.—Miss S., aged fifty-two. Seen with Dr. Walker, Huddersfield. Twenty-six years' history of ulcer. Vomiting. Great dilatation. Pain. Tenderness. Operation September 1, 1899. Hour-glass contraction centre of stomach. Stricture just admitting a No. 7 catheter. Great thickening. Gastroplasty.

Bone bobbin. Recovery. November 1, 1899, had gained 26 pounds. Well 1901.

CASE 7.—Mrs. A. P., of Keighley, aged thirty-six. Seen at infirmary. Ten years' history. Dilated hour-glass stomach diagnosed by lavage, etc. Great vomiting. Weight 7 stones 1 pound. Contraction of pylorus and also hour-glass, very contracted stomach, generally ulcerated. Operation October 5, 1899 (pyloroplasty and gastroplasty). Two bobbins. Died fourth day after second operation.

CASE 8.—Miss W., aged twenty-seven. Seen with Dr. Ellis of Halifax. Eight years' symptoms. Pain two hours after food and vomiting. Lost a stone in two years. Contraction just admitting tip of finger 3 inches from pylorus. Operation March 21, 1900 (gastroplasty). Bone bobbin. Recovery 1900. Several pounds heavier than before operation.

CASE 9.—Mrs. M. B., aged twenty-nine. Seen at infirmary. Four years' history of pain and vomiting. Hæmatemesis and melena. Hour-glass stomach. 8 stones 9 pounds. Operation March 22, 1900. Recovery April 30. Weight 8 stones $12\frac{1}{2}$ pounds.

CASE 10.—Mrs. M. P., aged twenty-seven. Seen with Dr. Waugh, Skipton. Hour-glass stomach. The constriction was about 4 inches from pylorus; the passage between the two sacs equalled a No. 12 catheter in diameter. There was marked induration and puckering, but no adhesion to the abdominal wall or elsewhere. The strictured neck was divided by an incision about $2\frac{1}{2}$ inches long in the transverse direction, and stitched up vertically, the mucous membrane with a continuous catgut suture, and the serous with a continuous silk suture. Two additional interrupted sutures were applied at each end of the wound. No history of gastric ulcer. Has complained of irregular attacks of pain in epigastric region for eleven months, always associated with the taking of food, and coming on about one hour after a meal. Vomiting occasional and irregular, in rather large quantities; no blood. On examination, stomach distended and splashy; contractions seen when distended. Medical treatment has proved unavailing. Operation April 4, 1900. Recovery. Vomiting for five days after the operation, blood-stained. Since then perfectly well. Complete recovery. Enjoys perfect health.

CASE 11.—Mr. D. M., of Halifax, aged forty-four. Seen at infirmary. Twenty years' history. Dilatation. Hour-glass 2 inches from pylorus. Operation June 7, 1900 (gastroplasty). Bone bobbin. Recovery.

CASE 12.—Mr. H., aged fifty-two. Seen with Dr. Hearder, Ilkley. Three years' history of pain and vomiting. Epigastric

tenderness. Stomach dilated. At operation hour-glass stomach, but stricture not extreme. Cardiac complement dilated. Weight 8 stones 6 pounds. Operation October 12, 1900 (posterior gastro-enterostomy). Recovery. March 4, 1901, letter to say well. Weight 9 stones 11 pounds.

CASE 13.—Three years' history. In one attack perforation. Strong adhesions to liver and colon. Contraction in centre of stomach. Operation November 15, 1900 (posterior gastro-enterostomy). Recovery.

CASE 14.—Mr. J. H., aged fifty-three. Seen at infirmary. Two years' history. Lost 3 stones. Hour-glass contraction 3 inches from pylorus. Operation December 6, 1900 (posterior gastro-enterostomy). Recovery.

CASE 15.—Mr. E. C., aged forty-five. Seen at infirmary. Ailing for five years. Pain in epigastrium radiating to left chest. Is worse after food, pain coming on 'within half an hour,' and lasting for two to four hours unless relieved by vomiting. Frequently vomited about an hour after food. Never any blood. Lately the pain has been almost constant, aggravated by food, eased by vomiting. Has lost 2 stones 12 pounds. Dilated stomach. On distending with CO_2 , a notch was noticed at the upper border of the stomach, and a tentative diagnosis of hour-glass stomach was made. Free HCl . A trace of lactic acid and a few rod-shaped bacilli. Operation January 24, 1901. An hour-glass stomach. The scar of the ulcer was equal in size to a florin, was situated close to lesser curvature, and nearer cardiac orifice than pyloric. Much puckering and induration of surface. No adhesions. The index-finger entered, but could not pass the stricture. An incision 3 inches long was made transversely, and stitched longitudinally in two layers. A slender adhesion of gall-bladder to pylorus was divided. Recovery. Within three weeks was eating ordinary diet.

CASE 16.—Mrs. I. V., aged twenty-eight. Seen at infirmary. Symptoms of gastric ulcer for more than five years. Was under treatment at beginning of illness at the infirmary. Has been gradually getting worse. Vomits now after every meal; pain and vomiting come on about half-hour to one hour after food. Vomit is very 'sour.' On examination, hour-glass stomach. On distending with CO_2 , the cardiac half increased considerably, forming a very large tympanitic area. The pyloric half distended but little; the division clearly seen. On auscultation a forcing, gurgling sound clearly heard. Operation March, 1901. At the operation an hour-glass stomach. The cardiac side of constriction much dilated, and larger than a normal stomach. Rather beyond the middle of the organ a constriction that would just

admit the forefinger; round constriction much induration and many adhesions: especially noticeable was one thick, cord-like one coming from the liver. This was divided between ligatures. Liver was slightly torn on separating widespread adhesions along lesser curvature. Below it on each side the stomach sagged, and between the two cavities an anastomosis was made, which readily admitted three fingers. Recovery complete and uneventful.

CASE 17.—Miss P., aged thirty. Seen with Dr. Mackenzie of Burnley. Indigestion from age of fourteen. For years pain after food. Had hæmatemesis about four or five times a year; acute stomach symptoms lasting for six or eight weeks. Dilatation to level of the pylorus; after CO₂ to 2½ inches below. Tenderness. Irregular outline on distension. Has not had a good meal for eighteen months. Very thin and feeble. Operation April 2, 1901. Stricture near cardiac orifice. Recovery.

CASE 18.—Mr. J. A., aged fifty-five. Seen at infirmary. Stomach troubles for sixteen years. At first pain after food and occasional vomiting. Five years ago an acute attack of hæmatemesis, melena, and general swelling of the body, which it was feared might prove fatal (? perforation). No ease in stomach since then, constant vomiting, pain after every meal, and great wasting. Now looks thin, pinched, and shrivelled. For three weeks has had no food, only sips of water and nutrient enemata. On examination, dilated stomach. Free HCl. Operation. Hour-glass stomach. At first was thought to be dilated stomach. On tracing stomach towards pylorus, an extremely narrowed isthmus (barely as thick as the little finger) was come to, which was supposed to be narrowed pylorus, but on tracing beyond it stomach still found. On invaginating a finger from each side of constriction, no opening could be felt. Many adhesions separated until all was clear and free. Then incision into stomach on cardiac side of isthmus, and a probe-director passed through constriction, which it fitted snugly, the opening being no bigger than a No. 4 or No. 5 catheter. Gastroplasty performed. On pyloric side of stricture a column of mucous membrane, forming a bridle stricture. This was ligatured, cut each end, and removed. Recovery complete.

Total: eighteen cases. One death.

CHAPTER XII

THE COMPLICATIONS OF GASTRIC ULCER (*continued*)

Dilatation of the Stomach.

THOUGH gastrectasis is by some authors only treated as a symptom, it is one of such importance that in many cases it may truly be said to be a disease in itself; this is certainly the case in that serious and often fatal form known as 'acute dilatation.'

A medical friend, whose practice lies among mill-operatives, told us that a moderate degree of dilatation was almost a constant symptom among them, owing to their living so much on tea and farinaceous food; and it is generally known that well-marked dilatation is usually seen in gross feeders, or in those living almost solely on bulky farinaceous food, such as potatoes. The capacity of the stomach cannot therefore be taken as a guide in estimating the dilatation that should come under the notice of the surgeon, and, in fact, it is only in the well-marked cases that a surgical opinion is sought. Unfortunately, the aid of surgery is too frequently put off until extreme emaciation has ensued and the patient is almost moribund.

The causes of dilatation of the stomach are :

1. Mechanical obstruction at the pylorus, or near it, or in the duodenum—(a) from cicatrization of a simple ulcer at or near the pylorus; (b) from cancer of the pylorus; (c) from perigastritis leading to stricture or to kink of the pylorus; (d) from hypertrophy of the pylorus and spasm as a sequel of ulceration, which may continue long after the original ulcer has disappeared; (e) from fibroid thickening of the pylorus; (f) from polypus; (g) from congenital stenosis; (h) from

tumour outside the pylorus; (i) from pressure on the duodenum by chronic pancreatitis when the head of the pancreas is embracing the duodenum; and (j) from pressure of mesenteric vessels as they cross the duodenum. (k) Terrier records two cases of pyloric obstruction due to gall-stone ulcerated through the gall-bladder into the pylorus. (l) Bartels and W. H. Bennett record cases of gastric dilatation dependent upon the dragging of a movable right kidney producing a kink of the pylorus, a condition which can be relieved by nephrorrhaphy (*Brit. Med. Jour.*, February 3, 1900). (m) From kink due to gastropotosis (*q.v.*).

2. Dilatation from atony from various causes not mechanical, but persisting after the original cause has ceased to act.

3. Acute dilatation from causes not yet well understood.

Diagnosis.

Although in cases brought before the notice of the surgeon the diagnosis is usually already made, he will need to verify its correctness for himself, and if possible to arrive at the probable cause. Where there is great dilatation, the stomach soon becomes also displaced downwards. Dilatation is always accompanied by diminished passage of the stomach contents onward, and is usually associated with vomiting, the vomiting differing from that which occurs in any other condition. For instance, it does not occur after meals, nor even every day, but usually every second or third day, and more frequently at night than in the day; and when the vomiting occurs, it is, as a rule, in large, or even in enormous, quantity, the vomit consisting of fermented material with mucus, and sarcinæ and yeast cells are usually present. When the dilatation is dependent on ulcer, the vomiting may be very acid, owing to the presence of excess of free hydrochloric acid. If, however, the dilatation is dependent on cancer, the acidity is due to lactic acid, and hydrochloric acid will be in small quantity or absent. Though patients with dilated stomach do not, as a rule, vomit after food, they complain of a sense of heaviness and discomfort, and have flatulent eructations, these symptoms becoming more and more intense as the stomach contents

accumulate, until relief is obtained by vomiting. As a rule, the first sign noticed in stomach dilatation is the splash on succussion of the abdomen, this being the more marked the greater the capacity. If the patient has previously vomited, the stomach splash may be absent, but it is usually obtained by allowing him to drink freely of warm water. Constipation and diminished secretion of urine are nearly always present. Where the obstruction is mechanical, visible peristalsis from left to right can frequently not only be felt, but observed through the abdominal wall; and if visible peristalsis be present, it is always indicative of considerable pyloric obstruction, which will probably only yield to surgical treatment. Loss of flesh, diminution of body temperature, coldness of the hands and feet, and general feebleness, are characteristic of the later stages. Tetany is sometimes present, and if well marked may even lead to a fatal termination; but before this stage is reached, cramps in the muscles of the forearm and drawing inwards of the thumb—otherwise a tetanoid condition—are usually noticed. The amount of dilatation may be ascertained by distending the stomach with air introduced through a tube and pumped into it by means of a Higginson's syringe. This can be done with very little discomfort and without danger. A simpler method which we frequently employ is to give a dose of tartaric acid in water, immediately after one of carbonate of soda, when, if the patient is recumbent, inspection, palpation and percussion show the increase in size of the organ.

As to the cause of dilatation, the history materially helps. If it be simple, the history is usually a question of years, but if malignant, of months only; but in the latter case a tumour is much more frequently present than in the former, and an examination of the stomach contents after a test-meal is also of service. In dilatation from ulcer, there will be usually a long history of ulceration, possibly with vomiting of blood, but it is quite possible for an ulcer of the pylorus to pursue a quiet course and for a long history to be absent. That peculiar form of dilatation known as acute may apparently occur as a result of spasm without organic pyloric obstruction. It is highly probable that nearly every case of extreme dilatation

of the stomach has some mechanical explanation, and can only be efficiently treated by surgical means. We know that this view is one which will raise some criticism, but we think that time will prove that the statement is correct. We do not of course refer to those cases of moderate dilatation which are so commonly seen, and which are associated with atonic conditions and with chronic catarrh, but to the cases of dilatation producing the characteristic symptoms just mentioned.

Treatment.

The treatment in any form of gastrectasis will at first be medical and general, but if in a short time weight and strength be not definitely gained and maintained, with relief to pain and discomfort, then time should not be wasted by persisting with lavage and medical treatment for months, until the vital powers have become sapped and the patient reduced to the last extremity of exhaustion, before surgical treatment is advised.

Surgical Treatment.—If the contents are offensive, the stomach should be washed out for a day or two before operation; and during twelve or twenty-four hours rectal injections may with advantage supplement light stomach feeding. The last lavage should be a few hours before operation. A subcutaneous injection of 10 minims of liquor strychninæ (B.P.) may with advantage be given just before the operation, so as to forestall shock, which may also be further lessened by giving a pint of saline solution by the rectum, and by operating on a heated operating-table. After exposing the stomach by an incision in or near the linea alba above the umbilicus, a diagnosis of the cause will be speedily made by inspection and palpation of the stomach and pylorus. If there be stricture of the stomach itself, either from adhesions caused by perigastritis or from ulcer, leading to hour-glass contraction, it must be treated in one of the ways previously described. If the dilatation be dependent on adhesions of the pylorus, and these can be detached, leaving the pylorus free, they should be dealt with as described (see *Gastrolysis*). If there is a stricture of the pylorus, it must be treated in one of the

several ways to be mentioned immediately (pylorodiosis, pyloroplasty, gastro-enterostomy or pylorectomy), according to its nature.

Pylorodiosis.—If the narrowing of the pylorus be due to spasm or hypertrophy of the circular muscular fibres, pylorodiosis, or dilatation of the pylorus, may be indicated. This is known as Loreta's operation, since it was he who first employed the method as a definite operative procedure in 1884 and brought it before the profession. But in 1881 Richter had dilated the pylorus by bougies, and Hahn had also done the same. Hahn also advocated rapid dilatation by invagination through the stomach wall. Loreta, however, practised and strongly advocated dilatation of the pylorus through an incision on the stomach side of the pylorus. Through the opening in the stomach he introduced first the right and then the left index-fingers into the pyloric orifice, and stretched it forcibly until the diameter was approximately 8 centimetres, after which the stomach wound was closed by sutures. Bull also advocated the use of bougies, and Barton employed a uterine dilator instead of the fingers.

Jaboulay, in a case of **cancer**, dilated the pylorus by invaginating the stomach wall by means of a finger, great relief to the patient resulting. This all sounds very simple, and when we hear of Loreta having had twenty-nine cases all successful, it would seem that the operation does all that could be desired; but there is another side to the picture, when we hear that, in the hands of many able surgeons, this apparently simple operation has such a high rate of mortality as 40 per cent., and that Loreta himself confessed to having had several deaths from hæmorrhage and peritonitis. Moreover, recurrence of the stricture seems to have occurred in so large a number of cases that the operation is scarcely likely to hold its own in competition with the more exact and safer operations of pyloroplasty and gastro-enterostomy. It probably has some use in that very limited class of cases where the stenosis is simple and dependent on spasm of the sphincter, which may either be caused by ulceration or occur independently of such a condition. A case has been related by Mr. Paul (*British Medical Journal*, 1896).

The patient was a man, aged twenty-one years. He was admitted into the Royal Infirmary, Liverpool, under the care of Dr. Caton, in November, 1895, for pain in the epigastric region and a lump. The lump proved to be a largely dilated stomach, in which splashing sounds could be easily produced. He was treated by careful dieting and washing out of the stomach; but not having materially improved in January, 1896, the case was transferred to me. The patient was anæmic, and decidedly of neurotic type. On January 6 the abdomen was found to be dilated, the pylorus was thick but not fibrous, and upon invaginating the anterior wall upon the forefinger into the pyloric orifice abnormal resistance was met with. This was gradually overcome by continued steady pressure, and ultimately the opening was overdilated without splitting by passing three fingers through it. No cut was made in the organ. The patient healed well, but was subsequently attacked with acute mania, and had to be sent to the county asylum, where he remained for five months before he got his discharge. He had no recurrence of the gastric symptoms.

We have had several cases similar to the above in which dilatation was successfully done by invagination. This is, however, the operation suggested by Hahn, and not by Loreta. Under the heading *Gastroplication* will be found reports of two cases in which Hahn's method of dilating the pylorus was adapted successfully by one of us (A. W. M. R.) at the same time that the dilated stomach was diminished in volume by *gastroplication*. In the chapter on *Congenital Stenosis* is also reported a case of Hahn's operation which was followed by relapse, and in that case a puckering of the pylorus seen at the second operation showed that the stretching had been followed by ulceration and stenosis.

The late Greig Smith held a favourable opinion of Loreta's operation, but many surgeons have told us that they have given up *pylorodiosis*, and our own feeling is decidedly in favour of *pyloroplasty* where no active ulceration is going on and where adhesions are absent, and of *gastro-enterostomy* where the pylorus is ulcerated.

Statistics of Loreta's Operation.—In the Hunterian Lectures we collected a series of 78 operations, of which 47 recovered, this giving a mortality of 39·7 per cent.

Pyloroplasty.—The principle of the operation consists in

obtaining an increase of the calibre in a stricture, by dividing the narrow passage longitudinally and closing the wound transversely.

The operation was performed first by Heineke in March, 1886, and his patient recovered. Mikulicz performed his first pyloroplasty in 1887, but the patient died; in his second operation in the same year the patient recovered. Of the first seventeen operations eleven recovered.

If the pylorus be free from adhesions the operation is of the simplest, as the pylorus can be brought outside the abdomen and surrounded by gauze pads or sponges, so that this heavy mortality of 35·3 per cent. must have been due to an improper selection of cases, as later results only show a mortality of 9 per cent. in Czerny's clinic (Stéudel) and 11 per cent. in our own cases. It is desirable to adopt all the usual precautions against shock, and the stomach should, if practicable, be washed out some little time before operation, so as to avoid the danger of soiling the peritoneum. The incision through the pylorus must be longitudinal, commencing on the stomach side of the sphincter, and being prolonged through it either by scissors or by the knife over a director. Blunt hooks or catch forceps placed in the wound convert the horizontal incision into a transverse one, and it is then closed by a double line of sutures.

The modification of the operation by the use of an internal splint in the shape of a bone bobbin, over which to apply the sutures, is a method that one of us (Mayo Robson) has employed in all his operations, and one which offers several advantages. For instance, only two continuous sutures are required for the mucous and peritoneal margins respectively.

The bone tube secures an immediate and thoroughly patent channel. It affords protection for from twenty-four to forty-eight hours to the line of sutures, by which time union should be established, and it prevents the new channel being inadvertently made too narrow. Although the bone bobbin originally invented for pylorotomy and enterectomy answers quite well, a recent modification, in which the barrel of the bobbin is lengthened, facilitates the operation. This modi-

fication of pyloroplasty has been followed by Rushton Parker (*British Medical Journal*, December 14, 1895) and other surgeons with success. Illustrative cases have already been quoted.

Koeppelin (*Lyon Médicale*, September 24, 1899, and *British Medical Journal*, Suppl., January 6, 1900) reports a modification of the operation known as 'submucous pyloroplasty.' The horizontal wound along the pylorus is made through the two outer coats, serous and muscular, of the bowel, and through the cicatrix, if there be one, and the exposed and unopened mucosa at once bulges like a hernia. The divided coats are then united vertically, as in ordinary pyloroplasty. Three reported cases of the submucous operation have proved successful. The first patient was a girl, aged twenty-two years, who was subject to spasm of the pylorus. The second patient was a woman, aged sixty years, who had suffered from cancer. Marked relief followed the operation. Eighteen months later the second patient underwent gastro-enterostomy with temporary benefit. Jaboulay of Lyons performed the third submucous pyloroplasty in June, 1899. The patient was a man, aged forty-two years, who had suffered eight years previously from symptoms of gastric ulcer, followed later by evidence of pyloric obstruction. He at length vomited incessantly, suffered from intense pain which necessitated large doses of morphia, and became very thin. At the operation cicatricial stricture of the pylorus was discovered. The cure was complete. Koeppelin maintains that this modification is safer than the older pyloroplasty. The advantage lies in the avoidance of opening the stomach cavity. As lessening the danger of sepsis, the modification may be occasionally employed, but it should certainly never be performed in the presence of ulcer or cancer of the pylorus.

If, owing to the cicatrization of the ulcer, there be extensive hypertrophy of the pylorus, with a large amount of thickening, pyloroplasty is insufficient, as in such cases contraction will be likely to recur. Here pylorotomy may be performed, as in cases already related; or, better still, gastro-enterostomy, which is a simpler, quicker, and safer operation. Numerous

and firm adhesions, active ulceration, and the presence of new growth, are also contra-indications for pyloroplasty.

Dr. Maurice Richardson (*Boston Medical and Surgical Journal*, November 30, 1899) advocates partial excision of the stricture where there is extensive thickening and well-marked stricture, as in the following case in a man aged fifty-four years. The pylorus was extensively thickened and tightly constricted. The longitudinal incision was made for 3 inches through the stomach, the stricture, and the pylorus. The incision was converted into a lozenge shape or a broad V by removing a considerable portion of the cicatrix of the anterior wall of the pylorus. By bringing together the opposing surfaces of the duodenum and the stomach, a wide lumen was procured. The mucous membrane was first united by a continuous suture, and the peritoneum by an interrupted silk Lembert's suture. The patient was in good health five months later. This pyloroplasty with partial excision seems to be the right practice in some cases of bad organic stricture and in active ulcer of the pylorus.

The dense tissue being cut away, the lozenge-shaped incision can be readily sutured so as to become transverse; while if a simple longitudinal incision is made through the tissues of a dense stricture, it is impossible to convert it safely into a transverse line of sutured wound owing to the great tension if the two ends be made to meet in the middle. A case of ours reported under *Excision of Ulcer*, is a good example of this method of performing pyloroplasty.

If on opening the stomach or pylorus a polypus be found as a cause of the obstruction, it must be removed, and, if necessary, the operation can be completed by a pyloroplasty.

Dilatation dependent on Pressure outside Pylorus.—If the dilatation be dependent on an **obstruction outside the stomach**—as, for instance, a tumour of the pancreas, liver, or gall-bladder—relief may be given by removing the tumour, or, if that be impracticable, by gastro-enterostomy. The instance reported by Dr. Ewart and Mr. Jaffrey (*Lancet*, October 28, 1899, p. 1155) is a case in point, where vomiting, incapable of relief by medical means, was dependent on an aneurism flattening out the pyloric end of the stomach and

causing obstruction. The following is an account of the operation, with remarks by Mr. Jaffrey:

Dr. Ewart asked me to see this case in consultation with him on August 26. There was a swelling midway between the umbilicus and the ensiform appendix, which appeared to me to pulsate more freely than one would expect from a growth of the stomach lying over the aorta. However, taking into consideration the symptoms and the swelling, we agreed that an exploratory laparotomy should be done. This I did on the following day. I made an incision from 4 to 5 inches long above the umbilicus. The stomach presented in the wound, and on examination it was found to be quite healthy, though dilated. On pulling the stomach out of the wound, there appeared to be between from $\frac{1}{2}$ pint to 1 pint of fluid collected in the most dependent part of the fundus. The colon appeared to be normal, and the walls of the stomach did not appear to be materially thinned. I attempted to press some of the fluid into the duodenum, but did not succeed in getting much to pass, and on further examination the swelling which we had felt through the abdominal walls proved to be a large fusiform aneurism of the abdominal aorta. It commenced about $\frac{1}{2}$ inch below the aortic opening of the diaphragm, and extended to the level of the umbilicus. The pyloric end of the stomach was flattened over the convex surface of the aneurism, so much so that it caused obstruction to the passage of the contents of the stomach into the duodenum. This seemed to me to be partly due to the weight of the dilated stomach and its contents, and of the colon and omentum. I deemed it advisable to pull as much as possible of the stomach over to the right side of the aneurism, so as to relieve this pressure. As the stomach seemed inclined to remain in its new position, I did not think it necessary to fix it in any way. The patient rapidly recovered from the operation, the wound was dressed with dry cyanide gauze, and the sutures were removed on the eighth day. There was slight vomiting, frequently recurring for several days, in connection with nausea, excited by the smell of brandy. The alarming symptoms disappeared, and the patient slowly improved, and became able to take solid food and to walk for short distances. She complained of burning sensations in the epigastric region, and had general hyperæsthesia of the abdomen, but the pulsating mass was less easily felt; this was no doubt due to the fundus of the stomach being placed between the aneurism and the abdominal wall.

Dilatation due to Obstruction by Cancer of the Pylorus.—If cancer of the pylorus be found to be causing the dilata-

tion, pylorectomy may be indicated if the disease be limited and there be no secondary infection; but if it be too extensive for removal, gastro-enterostomy will be the only treatment likely to afford relief.

Dilatation due to Pyloric Tumour the Result of Ulcer.—

In some cases of chronic ulcer with great thickening, pylorectomy may be the best treatment, and in others pyloroplasty, but in the greater number of such cases gastro-enterostomy will be the operation of choice.

A case related elsewhere is a good example of a large tumour of the stomach and pylorus producing gastric dilatation, in which one of us performed gastro-enterostomy, thinking the disease to be cancer. The entire disappearance of the tumour and the present well-being of the patient, however, prove that the disease was inflammatory thickening around an ulcer.

Other cases of dilated stomach owing to tumour of the pylorus the result of ulceration, treated by pylorectomy, pyloroplasty, and gastro-enterostomy, are related elsewhere, under the headings of these various operations.

Dilatation of Stomach due to Cholelithiasis and Consequent Perigastritis around the pyloric end of the stomach is so common a sequence of events that we have come to look on it as a concomitant ailment ('Diseases of Gall-bladder and Bile-ducts,' 2nd edit., p. 61).

Several cases out of many that we have had that were successfully treated by gastrolisis are related in the chapter on Perigastritis. A case is also related in the chapter on Fistula where severe stomach symptoms, characterized by dilatation and by vomiting, were remedied by detaching the gall-bladder from the pylorus and closing the fistulous opening.

Terrier ('Chirurgie de l'Estomac') records two cases of pyloric obstruction due to gall-stones ulcerating through the gall-bladder into the pylorus. In the chapter on Pylorectomy for Cancer, is recorded a case of cancer starting in the gall-bladder, extending to the pylorus, and producing dilatation of the stomach, in which at the same time partial hepatectomy, cholecystectomy, and pylorectomy were per-

formed successfully on August 10, 1900, the patient being now in good health eight months after operation.

Tetany and Tetanoid Spasms in Association with Gastric Dilatation.—It does not appear to have been generally noticed that severe muscular spasms of a tetanoid character, in rare cases amounting to severe or even fatal tetany, are frequently associated with dilatation of the stomach; yet we have noticed tetanoid symptoms in so many cases of dilated stomach that we have come to look at it as a frequent concomitant of the disease.

An important paper on the subject by our colleague, Dr. E. F. Trevelyan, published in the *Lancet*, September 24, 1898, p. 791, shows very forcibly that fully-developed tetany associated with stomach dilatation is a symptom of extreme gravity, and that in such cases a fatal termination is to be feared. To quote from Dr. Trevelyan's paper: 'If the term "gastric tetany" is allowed to include the milder as well as the severer cases—and there is no sufficient reason against this view—then the disease may turn out to be more common than is usually supposed. The transition between gastric tetany so called, tetany with gastro-intestinal symptoms, and ordinary tetany, would seem to be a gradual one. The prognosis of tetany occurring in gastric dilatation is undoubtedly very serious—nearly 75 per cent. of the cases die. The largest mortality occurs in cases where the spasm in the extremities is associated with tonic spasms in the head and trunk muscles or with clonic spasm. If the very strict views are held as to the disease, then the outlook is almost hopeless. Thus, of the eleven cases recognised by Frankl Hochwart, only one recovered. There is a danger here, as in some other diseases, that the fatal issue is raised to be the chief criterion as to the nature of the affection.'

Our own experience of tetany and of the severe muscular spasms in association with gastric dilatation leads us to think that we may possibly take a more hopeful view if the cases be treated surgically at an early period. The following cases will serve to illustrate our views. In the first case the tetany was so pronounced that the question of strychnine-poisoning crossed our mind. In the second

and third cases, though there were well-marked tetanic spasms, the cramps were limited to the extremities and the abdomen.

CASE I.—A man, aged thirty-four years, was sent to one of us (Mayo Robson) by his medical attendant in January, 1895, with a view to having something done in the Leeds Infirmary to relieve his condition. He had been suffering for five years from pain after the ingestion of food, with attacks of vomiting. Latterly his condition had become aggravated, the pains occurring from half an hour to one hour after each meal, and being relieved only by vomiting, so that for the last six months he had had to give up his work as a printer. For some time before coming under our notice there had been very evident peristalsis from left to right in the epigastric region. Throughout the period over which his stomach symptoms extended, his bowels had for the most part been very constipated, but there were occasional attacks of diarrhoea. During this time he had attacks of what he described as ‘cramps’ in his limbs, and especially in his legs. He had lost very considerably in weight, as in December, 1892, he weighed 9 stones $7\frac{1}{2}$ pounds.

On examination, there was found well-marked dilatation of the stomach; but the feature of the case which presented most interest in connection with the present question was the occurrence while under observation of the severe tetanic spasms, affecting almost all the muscles of the body. So extreme were these and so widespread—the muscles of the trunk and of the cervical region, as well as those of the limbs, being affected—that on January 17 the question of possible strychnine-poisoning was raised. As palliative treatment of the stomach condition gave no relief, the stomach was exposed on January 24, and the diagnosis of cicatricial stenosis, with hypertrophy of the pylorus, was confirmed. Pyloroplasty was done, a bone bobbin being employed to insure patency of the new pylorus. Recovery was uninterrupted, and, although the cramps were present up to the time of operation, he never had even a threatening of cramp afterwards. On February 15 he was able to take a mutton chop for his dinner without inconvenience, and by March 2 (five weeks after the operation) he had gained $8\frac{1}{2}$ pounds. Since then he has done very well, and two years after the operation he had quite recovered his strength, and was working as usual, his weight then being just over what it was in December, 1892, and quite 2 stones above what it was at the time of the operation. There had been no recurrence of any ‘cramps’ or of muscular spasms of any kind. In a letter received at the beginning of 1899, he speaks of some

stomach disorder, but he adds: 'You will please understand that I am a new man to what I was when you saw me last.'

CASE 2.—A man, aged twenty-four years, was seen by one of us (Mayo Robson) on October 5, 1897, in consultation with his private medical attendant, on account of severe painful cramps of the extremities and of the abdomen, with persistent vomiting. He gave the history of having had pain after food for several years previously, and of having vomited blood, since which time he had never been well and had gradually lost flesh. For some little time before we saw him he had vomited every day, unless the stomach was washed out, and from weighing over 10 stones he had diminished to a little over 8 stones. There was well-marked dilatation of the stomach, but no pyloric tumour could be felt, and simple stricture of the pylorus was diagnosed. He was admitted to the infirmary in October, and on the 21st pyloroplasty was performed, as the pyloric orifice would only permit the passage of a No. 10 catheter. The longitudinal incision in the pylorus was sutured vertically over one of the bone bobbins. Recovery was uninterrupted, and from that time the cramps and vomiting ceased. He returned home within a month. On October 23, 1898, the following letter was received from him: 'It is with a grateful heart I write to thank you for the good received at your hands twelve months ago. I am thankful to say I have never had any trouble with my stomach since. I feel it my duty to acknowledge the good I received, and also to thank you for your extreme kindness.'

CASE 3.—A woman, aged twenty-nine years, was sent to one of us (Mayo Robson) from the East Coast, in the spring of 1895, suffering from severe pain in the abdomen, associated with vomiting and loss of flesh. There was well-marked dilatation of the stomach, and the pain always started on the left side of the abdomen and passed to the right, on which side, just below the ninth rib, there was well-marked tenderness, with rigidity of the right rectus muscle. Operation was declined, and we did not see the patient until nearly the end of the year, when she said that the pain in the abdomen was excruciating and recurred every day. She said it was associated with severe cramp in the limbs, especially in the legs and thighs, and that at night she was kept awake by the pain. Vomiting of large quantities occurred daily, and she was steadily losing weight and strength. Her symptoms began in 1888, and she had lost 2 stones in weight between that year and 1895. On December 14 we opened the abdomen, and found active ulceration of the pylorus, which was adherent to the gall-bladder, liver, and abdominal walls, and was so much thickened as to form a distinct tumour. Pyloroplasty was performed

after the adhesions had been separated. Recovery was uneventful and satisfactory in every way, and she returned home within the month. She had never any return of the tetanic symptoms, and a report sent in March was to the effect that she had gained flesh and was 'well.' In July, 1896, we saw her again for stomach symptoms, but without much loss of flesh. In 1897 and 1898 the vomiting, loss of flesh, and well-marked stomach splash showed that the pyloric trouble had recurred, and as a distinct tumour of the pylorus was felt, which was believed to be simple inflammatory induration, gastro-enterostomy was performed in October, 1898. She made a good recovery, and has been quite well since. A letter in December, 1899, states that she is quite well and has fully regained her weight.

The interesting point in this case is that there was no return of the painful cramps in the limbs after the first operation.

Though tetany occurs apart from gastric dilatation—for instance, in children during teething, when it is frequently associated with gastro-intestinal disorders, and not infrequently merges into general convulsions—and in other conditions possibly apart from stomach disorders, yet tetany or painful muscular spasms of a serious character are so frequently associated with gastric dilatation that one cannot ignore the association, and pronounce it merely accidental. It is curious that we have seldom seen the symptoms in other than dilatation due to simple causes, such as adhesions of the pylorus to the gall-bladder or liver, or stricture of the pylorus due to the cicatrization of ulcers. We have seldom seen it in simple unobstructive dilatation, or in dilatation due to cancer of the pylorus, though Dr. E. F. Trevelyan gives single examples of its association with both in his paper; and in one of our cases of cancer tetany was well marked and very distressing. The immediate cause of tetany is somewhat obscure, but as our views are based on clinical experience they may be worth mentioning. We have noticed that the exacerbations of the tetanic state (especially in the first case related) were always associated with a painful contraction of the stomach, and that when the wave of contraction had reached the pylorus, the latter, which was previously incapable of being felt, formed a distinct hard tumour. The

abdominal pain then became very intense, and the tetanic cramps in other muscles came on, or, if already present, became intensified. From this sequence of events we have come to the conclusion that the cause of tetany is a double one—first, the absorption of some poison from the dilated stomach which increases the excitability of the nervous system; and, secondly, a reflex effect produced by the painful contraction of the pylorus. The practical outcome of these observations is that, where tetany or allied conditions are associated with gastric dilatation, surgical treatment in the shape of gastro-enterostomy or pyloroplasty is well worth considering before the symptoms become so severe as to lead to the almost hopeless condition described in the report of some of the fatal cases. In the case of children suffering from tetany, which is usually accounted for by the irritation of teething, it may be advisable to examine the size of the stomach as a routine measure; for we suspect that in many cases it will be found that there is dilatation due to congenital stenosis or to spasm of the pylorus. We have shown elsewhere that pyloric trouble in children and young adults is much more common than has been generally thought.

In the case of adults suffering from painful muscular spasm and cramps in the arms and in the gluteal muscles, it may also be well to remember the frequent association of gastric dilatation and tetany; for on several occasions recently where we have been consulted for these conditions we have found well-marked stomach dilatation, previously quite unsuspected.

CHAPTER XIII

DILATATION OF THE STOMACH FROM OTHER CAUSES

Acute Dilatation of the Stomach.

ACUTE dilatation was first described by Dr. Fagge, his paper being illustrated by two cases, both in men (one thirty and the other twenty years of age), and both ending fatally. The symptoms were those of largely distended stomach, coming on suddenly, accompanied by pain and diminished secretion of urine, followed by death. Many other cases of the kind have since been reported, and the subject was discussed in an able paper by Dr. T. N. Kelynack (*Medical Chronicle*, May, 1892), where will be found a reference to all cases previously reported. Pepper and Stengel suggest that the immediate cause is spasm of the pylorus. Carion and Hallion (*Semaine Médicale*, August 21, 1895) have shown that the section of the pneumogastric nerves in the dog leads to dilatation of the stomach, and to symptoms in many cases resembling those of uræmia. It seems probable that the symptoms are dependent on the absorption of toxins from the cavity of the stomach, just as in some cases absorption from a dilated stomach leads to tetany. In a case of Sir William Broadbent's (referred to in Dr. Dreschfeld's article in Professor Clifford Allbutt's 'System of Medicine') 8 pints of fluid were removed by the syphon. No sooner, however, was this removed than the stomach began to refill and rapidly regain its former dimensions. In the Leeds Infirmary we have had at least four fatal cases of this kind, under the care of Dr. Barrs, Mr. T. R. Jessop, Mr. W. H. Brown, and

one of us (Mayo Robson) respectively. Mr. Brown's case has been reported in the *Lancet* for October 14, 1899, p. 1017:

In this case a man, aged fifty-five years, said to be suffering from intestinal obstruction, was admitted into the hospital. He was in his usual good health up to forty-eight hours previously, when suddenly he was seized with intense pain in the abdomen accompanied by incessant vomiting; the vomiting continued until three hours before admission. On admission the hands were cold, the pulse was small and thready, and the face was pinched and sunken. The abdomen was distended above the pubes, but flattened at the sides and epigastrium; it was resonant, except between the umbilicus and pubes, where it was dull. Fluctuation could be felt, and a succussion splash was obtained. The temperature was subnormal. Earlier in the day the bowels had been moved slightly, but no urine had been passed since the onset of the illness—*i.e.*, for forty-eight hours. The abdomen was not tender, but the patient was in great pain, turning from side to side constantly, and asking for relief from his agony. A catheter was passed, and about a drachm of bloody urine was withdrawn. An exploring syringe was passed into the fluctuating swelling midway between the umbilicus and pubes, and withdrew about 2 drachms of thick greenish fluid, with a curious smell recalling the contents of a pancreatic cyst. As the general aspect of the case presented unusual difficulties with regard to diagnosis, and as it seemed certain that the man would die shortly if unrelieved, and that the pressure of the fluctuating tumour was the cause of his suffering, Mr. Brown decided to operate. Ether was given, and the abdomen was rapidly opened over the most prominent part of the swelling. A tense, thin-walled, rounded cyst was found, which contained a dark liquid with some gas. As no colon could be seen or felt, and as the tissues of the cyst wall seemed to be more like peritoneum than any viscus, Mr. Brown drew it to the surface, opened it, and let out about 3 pints of dark-green viscid fluid closely resembling that of a pancreatic cyst. The walls were stitched to the skin, and the wound was closed. The patient rallied from the operation, and expressed himself as being relieved, but he died five hours later. At the necropsy the cyst was found to be a dilated stomach, which would easily hold 5 pints; there was no pyloric obstruction. The kidneys showed marked signs of nephritis, and were saccular; all the other organs were healthy.

Mr. Jessop reported his case before the Leeds and West

Riding Medico-Chirurgical Society. It also ended fatally after gastrostomy.

Our own case came on ten days after a duodeno-choledochotomy for the removal of a gall-stone impacted in the common duct; the patient was doing well in every respect until twenty-four hours before her death, when she suddenly began to vomit, the abdomen became enormously distended, the urine became suppressed, and the patient died in a state of collapse. At the post-mortem examination, beyond dilatation of the stomach, nothing was found to account for death. It is interesting that in this case there were adhesions of the pylorus to the liver and gall-bladder, which we thought might probably have been the cause of the trouble. We were, unfortunately, out of town at the time of the catastrophe; otherwise we would certainly have operated, though probably the result would have been the same, for when the gravity of the condition was recognised, and a colleague was called in to see the patient, she was pulseless and cyanosed.

Dr. Appel (*Philadelphia Medical Journal*, August 12, 1899) has reported a case where acute dilatation of the stomach supervened on an abdominal injury. The abdomen was opened for what was supposed to be intestinal obstruction, but three-quarters of the abdominal cavity were occupied by a dilated stomach. The stomach was opened, giving vent to a quantity of gas and fluid, the incision being afterwards closed, but the second night after the operation the abdomen became distended as before, and death rapidly ensued. At the necropsy nothing was found abnormal except the distended and dilated stomach. It was suspected that the great sympathetic abdominal ganglia might have been injured, but nothing was found wrong with them on examination. Fenger (*Clinical Review*, February, 1898) reports a case of acute distension of the stomach five days after cholecystotomy. The stomach-tube was used, giving temporary relief, but the patient died on the tenth day—that is, five days after super-vention of the stomach symptoms. The necropsy showed nothing amiss except an enormously dilated stomach. Dr. Box and Mr. Wallace (*Lancet*, June 4, 1898, p. 1538) report a case in a boy, sixteen years of age, following on a

blow on the epigastrium. Abdominal section disclosed a dilated stomach, which was incised and emptied, but in that case also death followed. Kirch (*Deutsche Medicinische Wochenschrift*, 1900) reports a case in a youth, nineteen years of age, who made a supper of soup and beer, which was followed by pain and uncontrollable vomiting. The stomach was washed out, and $5\frac{1}{4}$ pints of grayish-green fluid was evacuated. The next day another $2\frac{1}{2}$ pints were removed by the stomach-tube, but the patient died in the evening from heart failure, four and a half days after the beginning of his illness. At the post-mortem examination the stomach was found to have lost its normal shape, and to have the form of a long dilated tube reaching from the left hypochondrium to the true pelvis, and then turning sharply upwards to the abdomen.

Wiesinger (*Deutsche Medicinische Wochenschrift*, February, 1901, and *Philadelphia Medical Journal*, March, 1901) has related a case of acute dilatation of the stomach in which mechanical blocking of the orifices of the viscus by rotation seemed to be responsible for the distension.

The case occurred in a man of forty-one, who was taken ill immediately after a diabetic indiscretion, with the clinical appearances of intestinal obstruction associated with enormous distension of the epigastrium and left hypochondrium. There were attempts at vomiting, but nothing was brought forth. The distension increased, and operation was undertaken on the fourth day while the patient was in extremely bad condition. The large mass in the epigastrium proved to be the stomach. It was suspected at first that this was merely pressed forward by a cyst (possibly pancreatic) lying behind the stomach, as the mass felt like a cyst. The stomach was punctured and the contents drawn off, and it was found that the whole mass consisted of the tensely distended stomach. The pancreas itself was found to be normal, excepting for perhaps some enlargement. There were widespread areas of fat necrosis. The stomach was found twisted at an angle of about 180° , and fixed in this position. The cardia and pylorus were completely closed. The patient recovered completely, and had subsequently no digestive disturbances.

The case was notable for the complete cure of the fat necrosis. The latter condition was probably due to pressure

upon the pancreas by the enormously distended stomach. The occurrence of volvulus of the stomach was attributed to the displacement of the colon above the stomach resulting from the abnormal length of the mesocolon. After a partial volvulus had occurred, this was increased by the enormous secretion which took place in the stomach.

A careful analysis of all the recorded cases of acute dilatation would seem to point to a neuromyotonia, probably associated with spasm of the pylorus, but so far surgery seems to have been of little avail in these cases, and no treatment seems to have been of material service.

Nevertheless, we must not give up our efforts, and we would suggest that in every case of this kind, where stomach lavage has failed, but only then (for the stomach-tube is the first indication, no matter at what stage it may be recognised, unless, indeed, the patient be actually dying), the abdomen should be opened, and the stomach emptied and connected with the jejunum, thus providing for continuous drainage into the intestine. We believe that as yet this method has not been put to the test.

Although in the greater number of cases of stenosis of the pylorus requiring surgical treatment a general anæsthetic may be given, it is well to bear in mind that, if necessary, as in serious cases like those under consideration, the operation of gastro-enterostomy may be performed under local anæsthesia produced by Schleich's method. Herczel has reported two cases where he did gastro-enterostomy in this way, in both of which recovery was rapid. In another case which he did under a general anæsthetic pneumonia supervened, and he believed that the anæsthetic played a prominent part in its production. Czerny has remarked that a certain number of patients submitted to stomach operations suffer from pneumonia, owing to the predisposition caused by the cessation of abdominal respiration and the superficial character of the thoracic respiration, on account of the pain in the wound caused by costal movement. We have on several occasions performed operation of the stomach successfully under cocaine where we thought the patient too feeble for general anæsthesia, or where chest complications rendered chloroform or

ether inadvisable, and with very little pain, discomfort, or shock to the patient.

The accompanying drawing is taken from a case under the care of our colleague Dr. Barrs. The patient was ill with ulcerative endocarditis, and suddenly developed enormous abdominal distension, which proved rapidly fatal. There had been no previous stomach symptoms, and at the autopsy nothing was discovered to account for the condition.

But that the condition of acute gastric dilatation is not hopeless the following cases distinctly prove :

In one, a woman of thirty-five (under the care of one of us—A. W. M. R.), recovering smoothly from cholecystotomy, which had been performed a week previously, was suddenly seized with pain in the epigastrium, followed by vomiting, which soon became ineffectual in emptying the stomach. Rapid dilatation ensued, and the stomach not only formed a large swelling, filling up the superior abdominal region, but also extended well below the umbilicus towards the pubes. This, owing to pressure on the diaphragm, and through it to pressure on the heart and lungs, led to great shock, quick and oppressed breathing, and a rapid, feeble pulse, with signs of lividity and imperfect blood aeration. The urine was scanty, and, in fact, almost suppressed.

Strychnine was freely given subcutaneously, but no relief came until the stomach-tube was used, when a large quantity of gas and several pints of brownish fluid were evacuated; the lavage was repeated several times during the next two days, during which time alimentation was entirely rectal. It was interesting to note that the pulse and temperature were paradoxical, the former running up to 150 and the latter down to 97·3. All the symptoms passed off under treatment almost as quickly as they came, and in a week the stomach had returned to the normal size.

In another case, a lady of twenty-nine, who had had abdominal hysterectomy for a large myoma, and whose after-progress had been most satisfactory, the wound having healed by first intention, and the temperature and pulse having been normal throughout, was seized with pain over the stomach a fortnight after operation; this was followed by vomiting of frothy mucus with a few brownish streaks in it, and by distension of the abdomen, beginning in the epigastrium. On percussion the stomach was found to be down to the pubes, and on succussion a well-marked splash was easily obtained; the pulse became rapid and the face pinched, so that within thirty-six hours of being quite well the patient presented every appearance of impending death. The urine was

very much diminished, and for twenty-four hours almost suppressed. Strychnine was given subcutaneously and rectal feeding was adopted, but no relief was obtained until the stomach was washed out, after which relief was immediate and the patient steadily improved, though no food was given by the mouth for three days. Within a week the stomach had returned to the normal size. Here also the temperature and pulse were paradoxical, the former being subnormal and the latter very rapid. The only cause that could be assigned was the eating of a raw apple, but that may have had nothing to do with the condition. The patient said that she had always been subject to a weak digestion since childhood, but at the time of operation nothing abnormal was noticed in the stomach.

It seems not improbable that some of the cases of ileus after abdominal operations may be caused by acute dilatation of the stomach, which, when once initiated, tends to persist and get worse, owing to the distended stomach dragging on and kinking the duodenum, thus leading to shock by pressure on the heart, without there being any sign of sepsis. Hence, in all cases of ileus after operation the use of the stomach-tube should not be neglected.

Acute post-operative dilatation of the stomach is said by P. Miller (*Deutsche Zeitschrift für Chirurgie*, August, 1900) to be frequently due to compression of the duodenum by the superior mesenteric artery. He thinks that in the majority of such cases recovery occurs either spontaneously or as the result of stomach lavage. Where death occurs in such cases, Miller thinks that the fatal result is frequently attributed to peritonitis, whereas in truth it is due to the above form of intestinal obstruction. Some of the later cases we have described should possibly come under this form. If Miller's explanation be correct, the cause of the dilatation may be removed by rolling the patient over into the prone position. This measure was practised with success in the following case:

M. P., woman, aged fifty-eight, was sent to one of us (B. G. A. M.) by Dr. J. Ellison suffering from a large abdominal tumour, which proved to be a parovarian cyst. After operation matters progressed smoothly for twenty hours; then vomiting set in, and the stomach was found to be much distended, producing a

prominent bulging in the epigastric and umbilical regions, which contrasted very strikingly with the emptiness of the rest of the abdomen. The patient was rolled over on to her face, vomited three times within half an hour, the quantity on each occasion being over a pint, but almost immediately expressed herself as relieved. Vomiting ceased and did not recur, and the patient made a good recovery.

It is not improbable that the intestines, supported by the tumour, dragged downwards after their support was gone, and thus caused the superior mesenteric artery to constrict the duodenum. With the patient in the prone position such a cause would be removed.

Atonic Dilatation of the Stomach.

Dilatation from Atony is due to various general and local causes, and may persist after the original cause has disappeared. As we mentioned when speaking of dilatation of the stomach generally, pure atonic dilatation, apart from some degree of stenosis or some mechanical cause, is probably rare. The condition is due to a weakened state of the muscular coats of the stomach, so that there is deficient peristalsis, and the contents are not pushed towards the pylorus sufficiently rapidly for the stomach to empty itself in a normal time.

In these cases, even in the morning before breakfast has been taken, a stomach splash may be obtained on succussion, and if the contents be siphoned off, particles of food, with fluid, will be found—not necessarily coarse particles of food, as are found in dilatation due to true stenosis of the pylorus, but digested food that would easily pass the pylorus if normal peristalsis were present.

Symptoms.

The appetite is poor as a rule, though it may be abnormally increased. Thirst is increased, and there is a feeling of dryness in the throat almost constantly present. Flatus, relieved by eructations, is usually met with, and the expelled gas may have an unpleasant or disagreeable odour. There is a constant sense of oppression, with fulness at the

epigastrium, and frequently palpitation will be complained of. Vomiting occurs in advanced cases, and may be repeated daily or once or twice a week, the vomited matters being offensive, and containing yeast cells, sarcinæ, and other organisms. Free HCl will usually be found. Emaciation is usually present, and as the disease advances it may become extreme.

There are certain cases of dilated stomach of the atonic variety in which the chief symptoms depend on the great bulk of the organ. As descriptive of the amount of paralytic distension that is possible, Bamberger mentions an extreme case, in which the stomach held 70 pints of fluid (Gould and Pyke, p. 630). As these cases are frequently dependent on chronic catarrh or on some general cause not mechanical, it is not necessary in a surgical work to enter very fully into the etiology, except to say that the myasthenic variety of dilatation may be dependent on (*a*) fatty or colloid degeneration of muscle, (*b*) destruction of muscle fibres by ingested poisons, by ulceration, fibrosis, and cancer, and on (*c*) paresis of the nerves of the stomach.

General and medical treatment, supplemented, if need be, by electrical treatment and lavage, if carried out systematically and for a sufficient length of time, usually yield good results; but in some cases, despite regular lavage of the dilated organ, well-regulated diet, and general medical treatment, the dilatation persists, and the nutrition of the patient and the general health become seriously impaired. In such cases the operation of gastrorrhaphy or gastroplication may be worth considering.

Gastroplication.

Bircher performed the operation, and reported three cases in 1890, and Weir of New York published a paper on this subject in 1892. The reports show that the operation is a most beneficial one if the cases be well selected; but before performing gastroplication it should be clearly ascertained that there is no mechanical obstruction, either at the pyloric orifice or in the duodenum.

The following diagrams illustrate the method of folding

and diminishing the volume of the stomach adopted by various operators. In the slighter cases, probably, Bircher's operation would do all that is required, but in the more severe cases a method first described by one of us (B. G. A. M., *Lancet*, 1898) is the more efficient. The operation is neither

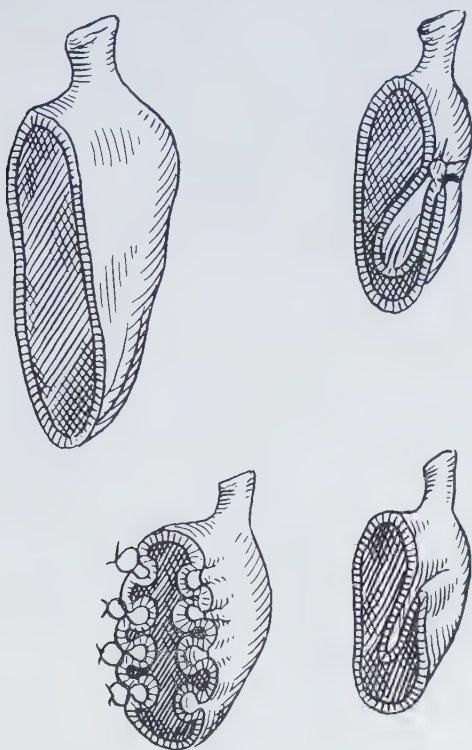


FIG. 45.—GASTROPLICATION.

difficult nor attended with serious risk, since there is no danger of sepsis, as the cavity of the stomach is not opened; and as the stomach can be drawn out of the wound to be sutured, the general peritoneal cavity is saved from long exposure.

In the Hunterian Lectures we collected all the reported cases, twenty-eight in number, showing a 7·1 per cent. mortality.

We have only seen two cases, in addition to the one referred to, that we thought suitable for gastroplication.

One patient, W. R., aged thirty-five years, who had been invalided for eighteen months, but who had had stomach symptoms for seven years, and who had tried lavage and other medical treatment for several years without benefit, expresses himself as

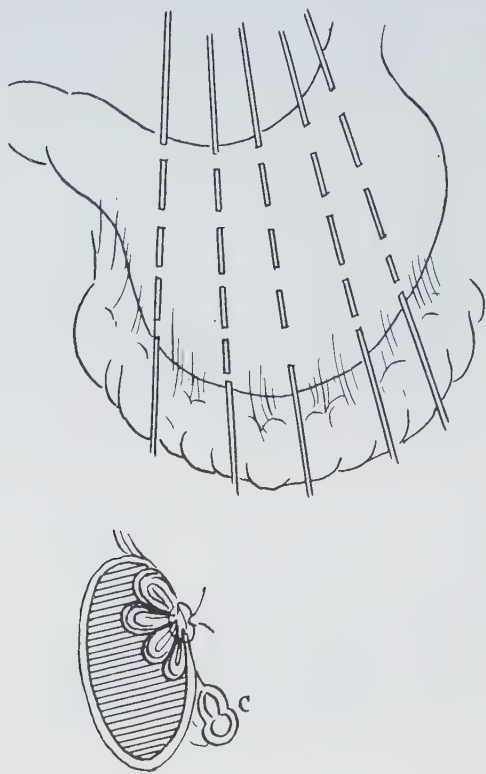


FIG. 46.—GASTROPLICATION. (MOYNIHAN'S METHOD.)

cured of all his former symptoms, and he certainly looks well, and seems able to take his food without any difficulty. The operation was performed on January 24, 1900, by Mayo Robson, after the plan first carried out by Moynihan, and at the same time the pylorus, which was thought to be narrow, was stretched by invaginating the anterior wall of the stomach, and pressing first the index, then the middle finger, then the thumb, and lastly two fingers, through it, until a freely patent channel was obtained.

In another case, a Mrs. R., aged fifty-six, was sent to one of us (A. W. M. R.) by Dr. West of Morley, with an enormously dilated stomach, reaching about to the pubes, and with a history of stomach symptoms extending over several years. Recently she had been entirely confined to bed, had lost all desire for food, and had become much emaciated. Gastroplasty and dilatation of the pylorus by Hahn's method were performed on April 23, 1900, with immediately brilliant results, and in two months the patient had gained over a stone in weight.

The after-history of this case is both interesting and important; for six months later, although she could take food and digest it well, she began to suffer from severe pain at the epigastrium, which, after a full meal at first, and later after any solid food, became so distressing that she had to resort to living on milk and liquid foods.

We were again asked to see her, and found her in considerable distress from pain at the epigastrium, associated with great tenderness, rigid section, and an obscure feeling of swelling, as if a tumour were present. On distending the stomach with CO₂, it reached an inch below the umbilicus.

Vomiting occurred at times, but was not a marked symptom. She weighed a stone more than when she was operated on, though Dr. West and her friends said that she had lost weight considerably since the pain began.

Lavage of the stomach, rest, and dieting giving no relief, it was decided to perform gastro-enterostomy, which was done on December 5, 1900.

On opening the abdomen, very extensive adhesions were found, clearly following on the gastroplication, as the anterior wall of the stomach, especially towards and at the pyloric end, was fixed to the liver and to the abdominal wall; and it was at this part where her pain had always been before, and where the tenderness was constantly felt. The gastroplication had produced the condition shown in the diagram, obliteration of the anterior wall, the greater and lesser curvatures being close together; but the posterior wall had remained stretched, and was only limited by the capacity of the lesser peritoneal sac, which it filled completely.

The pylorus was quite patent. The adhesions to the abdominal wall were separated; but as a large raw surface was necessarily left, it was felt that the adhesions would probably re-form. A posterior gastro-enterostomy was therefore done. Recovery was uneventful, and the patient left the 'home' within the month quite free from symptoms and feeling well. She could take solids and enjoy her meals. The improvement has continued.

CHAPTER XIV

PERIGASTRITIS

ADHESIONS of the stomach and pylorus to neighbouring organs are a common result of perigastritis, the causes of which may be extrinsic or intrinsic. Among the extrinsic causes are gall-stones, tuberculous peritonitis, local peritonitis from intestinal ulceration or from malignant growths in adjoining organs, typhoid fever, and possibly other fevers. Among the intrinsic causes, ulceration is by far the most frequent, though cancer and syphilis of the stomach must also be included.

Though at the time adhesions the result of perigastritis are conservative, and may frequently result in the saving of life by limiting the peritonitis, the result of perforation or of bacterial infection due to ulcer, yet later such adhesions may lead to great functional disturbance by interfering with the motor activity of the stomach and causing pain, disability, and other ailments. As we shall hope to show, these disturbances caused by adhesions may not be merely of a functional nature, producing dyspepsia and so-called visceral neuroses; but they may, and frequently do, cause dilatation of the stomach, vomiting, severe pain, and great loss of flesh.

In 1893 one of us (A. W. M. R.) read a paper before the Clinical Society of London on the subject of pyloric adhesions, and related several cases which had been cured or relieved of long-continued stomach symptoms by their division. This was, we believe, the first time that attention had been drawn to the importance of adhesion around the pylorus as a cause of dilatation of the stomach and other

digestive troubles. Since that time our experience on this subject has considerably extended, and we can now point to a very large number of cases (over fifty) of pyloric or other stomach adhesions, caused in some cases by gall-stones, in others by gastric ulceration, where the adhesions, though not the original disease, were of the first importance in producing the symptoms for which operation was undertaken, and where gastrolisis led to their relief or cure. Though in some cases the adhesions may be due to a perforating ulcer, it is by no means necessary that ulceration need be near perforation to lead to perigastritis; for in many cases, long before the peritoneum is reached by the ulcer, a local peritonitis occurs, leading to the pain and well-known local tenderness which characterize ulcer of the stomach, and then lymph is thrown out which may fix the inflamed region to contiguous organs.

Adhesions are found around the stomach in about 5 per cent. of all necropsies, and about 40 per cent. of all cases of ulcer of the stomach are associated with adhesions. Our combined experience in a very considerable number of abdominal sections, over 700 of which have been in the upper abdominal region, shows that pyloric adhesions are very much more common than is usually supposed, and that their importance is greater than is generally recognised even at the time of operation. This is especially the case in cholelithiasis, where we are accustomed to find gastric dilatation as a regular sequence of gall-stones, and to look for it as an ordinary concomitant sign; and in such cases it is always due to adhesions of the pylorus to the gall-bladder and liver.

Sometimes the adhesions may be strictly limited to the pylorus and gall-bladder, leading to a characteristic train of symptoms. In a case under the care of one of us (A. W. M. R.), 'acute dilatation' of the stomach came on suddenly and ended fatally within thirty-six hours, it being apparently due solely to pyloric adhesions, as a post-mortem examination revealed no other cause (see *Acute Dilatation*). At other times adhesions may extend from the pylorus along the lesser curvature of the stomach, fixing the upper border of the stomach firmly to the gall-bladder, cystic duct, and

under surface of the liver. When the pylorus is tied up in this abnormal position, not only are the natural movements of the pylorus and stomach interfered with, but the food has to be forced out at a higher level, and when the pylorus is alone fixed a kink forms, leading soon to well-marked dilatation with flatulence, chronic dyspepsia, and loss of flesh. Where perigastritis is due to ulceration, the adhesions are only found over the site of the ulcer, and if this be at the pylorus a double difficulty is presented, for not only is there fixation of the pylorus at an abnormally high level, but the pyloric orifice itself becomes stenosed from the contraction due to the healing of the ulcer. If the ulcer happens to be on the anterior wall of the stomach, it may lead to hour-glass contraction, as in cases related under that heading.

The symptoms vary according to the site and cause of the disease, from mere dyspepsia to serious apepsia, and the brief descriptions of cases given at the end of this chapter are selected as illustrating the different causes and effects of gastric adhesions.

Although cancer is a well-recognised cause of perigastritis in every region of the stomach, the symptoms from adhesions are merged in the more serious ailment; it is, therefore, unnecessary that we should further consider them at this moment, except to say that they seriously add to the difficulty and danger of pylorotomy or partial gastrectomy. The cases mentioned can leave no doubt in the minds of our readers as to the serious effect of pyloric and gastric adhesions, although it is a curious fact that many recognised authorities on stomach diseases barely mention them. The remarks that were made by several eminent physicians at the reading of the original paper on this subject before the Clinical Society of London showed that, although the subject was not unknown, its importance was certainly underrated. That we are not exaggerating its importance is shown by reports of cases by other observers. For instance, Hartmann and Soupault (*Revue de Chirurgie*, 1899, p. 340) relate cases where adhesions were the only apparent cause of gastric dilatation. Terrier, in his work on "Stomach Surgery" (1899), relates a case of a woman, aged sixty-two

years, whose gastric symptoms were relieved by breaking down adhesions.

Bireto related a very instructive case, resembling one above described, where a band was found attached to the lesser curvature of the stomach, about $1\frac{1}{2}$ inches from the pylorus, which ran obliquely downward to the anterior abdominal wall on the right of the umbilicus. When the stomach was full, the band dragged the upper border downwards, and produced a kink which led to stenosis. A case related by Mr. H. W. Page (*British Medical Journal*, January 23, 1899) is a good example, and many others can now be found scattered through medical literature.

The diagnosis in these cases rests on a careful consideration of the previous history, together with the presence of well-marked signs and symptoms, so that it is not generally difficult. There will usually be a history of gall-stones, typhoid fever, ulcer of the pylorus, or some local peritonitis in the pyloric region, months or years previously. This will have been followed by indefinite dyspepsia and flatulence, which later takes a very definite shape, consisting of discomfort and pain after food, especially after a full meal, so that the patient prefers to take several small repasts rather than one or two large meals. The pain and discomfort are at once relieved by the recumbent posture, so that a necessity to lie down or rest after every meal is suggestive. Relief is frequently found by the wearing of a belt, and this is usually discovered by the patient before advice is sought. The pain is often of a dragging character. At times it may be acute, and it is increased or brought on by lifting or reaching, say, to adjust a picture. Walking or any active exertion is shunned, and inability to perform ordinary duties is complained of. When dilatation of the stomach is well marked there may be loss of flesh and vomiting every few days, often in large quantity.

Besides the ordinary signs of dilatation of the stomach and the tenderness between the umbilicus and the ninth costal cartilage, as shown by the rigid right rectus, there is an important physical sign to be obtained by distending the stomach with gas, when, in case of pyloric adhesions, the

cavity of the stomach will be found to extend further to the right and higher than normal. An entire cessation of pain and freedom from dyspeptic troubles if the patient be confined to bed is suggestive, for it will be seen that under these circumstances the higher level of the pylorus is done away with, and the recumbent posture prevents the dragging of adhesions; but, after all, an exploratory operation is the only way of setting doubt at rest, and if these distressing symptoms have resisted long-continued medical treatment a surgical operation is clearly justifiable, though doubtless in some of the less severe forms careful medical treatment may lead to an amelioration of symptoms, and may give such marked relief that an operation will not be called for. Relief may be obtained by advising the patient to take small meals, to avoid bulky and fermentable foods such as potatoes and bread, to rest after meals, and to wear a well-fitting abdominal belt.

In some cases where relief ensues without operation, it is probably due to the stretching of adhesions and to their absorption, if the exciting cause has fortunately been removed; but in the more severe cases, where the adhesions are almost universal, such a fortunate termination of symptoms is scarcely to be hoped for, and in some cases the adhesions are so extreme that nothing short of gastro-enterostomy can prove of any avail.

Gastric adhesions may give rise to no symptoms, but usually they interfere with the motor functions of the stomach. Adhesions may be suspected (*a*) when there is a widespread tenderness in the epigastrium, extending beyond the stomach area, and associated with rigidity of both recti; (*b*) when lavage and other treatment fail to relieve the deficient motor functions; and (*c*) when after treatment for gastric ulcer the pain and tenderness persist.

Gastrolisis.

We have heard it asked, 'What is the use of simply detaching adhesions?' Fortunately, our experience in this class of cases is sufficient for us to give a very direct answer to this query, for we can point to many cases of cure where

men and women, formerly invalided by pain and dyspepsia, are now leading active and useful lives. Slight adhesions we are accustomed to separate with the fingers, firmer bands to divide between ligatures, going carefully to work until the pylorus is quite free. Where the omentum is available, we usually bring the right border upwards, and leave it between the pylorus and the gall-bladder and the liver, so that, should any adhesions form again, they will be in the form of a loose mesentery, and not binding, like adhesions to fixed organs.

The operation of gastrolisis, where adhesions are solely responsible for the stomach trouble, is a perfectly safe one, and in a large series of operations we have had no fatality. In the Hunterian Lectures we collected from all sources 77 operations, the rate of mortality being 2·5 per cent. Of these, 47 were personal cases without a death.

Wherever the adhesions are very firm, and especially where they are extending over a wide area, great care must be exercised in separating them, and when separated, in examining the stomach carefully to see if there is a fistula left, for in no less than seven cases we have had to close perforations under such circumstances; and, in several of them there was a clear history of perforation of gastric ulcer, with subsequent recovery, though the symptoms of ulceration had persisted and necessitated operative treatment.

A case of stomach and gall-bladder fistula (seen by Mayo Robson) in a lady of fifty-four, due to perigastritis of extrinsic origin, is described in the chapter on *Fistula*. When the adhesions were separated there was a passage into the stomach readily admitting a No. 6 catheter, which was easily closed by a purse-string suture, the gall-bladder opening being used for drainage, the patient making a good recovery.

In another case, that of a middle-aged lady, seen by Mayo Robson, with Dr. Johnstone of Ilkley, on separating the pylorus from the liver, an opening was found the size of a threepenny-piece leading into the stomach, the base of the ulcer being formed by indurated liver tissue. The case is more fully described under *Pyloroplasty*.

Curiously, on one day while operating at the Leeds Infirmary, one of us (A. W. M. R.) had two consecutive cases where recovery from perforation had occurred, leaving very firm adhesions. In one case, that of a middle-aged man, a patient of Dr. Robinson's of Low Moor, there were very firm adhesions of the pylorus to surrounding organs and to the omentum, and on separating the latter in order to perform pyloroplasty the round opening of a perforation was quite distinct. Dr. Robinson said that he recollected the date of the accident several months previously, and that he had prepared the patient for operation then, but under rest, opium, and abstention from food, he recovered. The ulcer was excised and pyloroplasty performed, the patient making a very good recovery. The next case was one of hour-glass contraction due to chronic ulcer, and here the history of perforation was also distinct, the patient at the time having been treated by rectal feeding for a week and being kept in bed for a month. Excision of the ulcer and posterior gastro-enterostomy was followed by recovery.

In another case (also under the care of Mayo Robson), of a middle-aged woman, a very firm adhesion to the anterior abdominal wall was evidently the site of a perforation, the history of which was very clear, and suspected by her medical man at the time, though the patient recovered. On separating the adhesions there was an opening admitting a No. 5 catheter leading into the stomach. It was readily closed by inversion of the edges and the use of a purse-string suture.

We have in the same way found adhesions to the large and small intestine and pancreas and the diaphragm.

The lesson to be learnt is that due care must be taken in separating firm adhesions, and the parts must also be carefully examined subsequently, not only for the arrest of hæmorrhage, but also to see that there is no fistula left.

Where gastric adhesions the result of perigastritis are present and not producing symptoms, being only discovered accidentally during the performance of other operations, we would not always counsel their division unless it can be readily done, since they undoubtedly do exist at times with-

out serious detriment to the patient. If the pylorus is patent, yet embarrassed by adhesions, we always separate them, and try to avoid their recurrence by interposing the right free border of the omentum between the raw surfaces left by the gastrolysis, thus substituting a long, freely-movable attachment for short, binding ligaments, should adhesions re-form. If, however, adhesions are very extensive, very short, dense, and firm, the operation of posterior gastro-enterostomy had better be done, as in some of the cases related below, and this especially if at the same time there is stenosis of the pylorus or an hour-glass stomach.

M. Merklen (*Société Médicale des Hôpitaux*, Paris, January, 1899) related the case of a man, aged forty, who, having had for three weeks crises of epigastric pain which radiated into the retro-sternal, and even submaxillary, regions, was on November 10, 1896, suddenly seized with acute pain in the left flank and all the signs of gastric perforation. The peritonitis was limited by previous adhesions, and a subphrenic gaseous abscess formed. On December 2 nearly a litre of pus was evacuated. The patient seemed to have perfectly recovered. But in January, 1897, severe pains again occurred. They came on five minutes after taking nourishment, and were increased by standing and walking. They originated in the pit of the stomach, and radiated behind the sternum and into the arms to the little fingers, thus resembling angina pectoris. Each attack lasted from thirty to forty-five minutes. After fourteen months of suffering, an operation was performed in March, 1898.

The stomach was surrounded by adhesions, which were divided, except the principal one, which was very dense and connected the stomach and liver. The patient appeared to be relieved, but the crises recurred four weeks later with the same localization and the same radiation. But they differed in not being provoked by food, appearing solely when the patient was standing or walking. Thus, gastric peristalsis was not painful, but the dragging on the gastro-hepatic adhesion in the upright position, especially after food, was. There was a hard and painful induration in the epigastric region. But for the history, cancer might have been suspected.

In June the part of the liver adherent to the stomach was removed with the thermo-cautery, and the wound was closed with catgut sutures. The gastric ulcer was resected in the same way. Permanent relief followed.

As to the diagnosis of perigastritis, M. Merklen argued that persistence of pain in spite of treatment was an indication, and the epigastric induration a proof. The pains were of two kinds—those produced by food and those produced by standing. The latter were explained by the position of the lesion, which was usually gastro-hepatic. Treatment consisted in dividing the adhesions or in resecting the ulcer and inflammatory new growths.

In the case of Mrs. R. (see p. 221) a second operation was necessitated by the pain solely caused by extensive adhesion following on the operation of gastroplication; for, although the stomach had been diminished in volume by the previous operation and the pylorus had remained patent, the adhesions had produced so much pain and distress during peristalsis and on exertion that the patient was entirely incapacitated and bedridden. Gastrolisis was performed, but as the adhesions were so very extensive, in order that the relief might be permanent and complete, it was considered advisable at the same time to perform posterior gastro-enterostomy. The patient made a good recovery, lost her pain, and is now well.

The following are illustrative cases:

ULCER OF STOMACH; DILATATION; PERIGASTRITIS. GASTRO-
LYSIS.

Mrs. A. H., aged forty-one, seen by Mayo Robson September, 1898. Fourteen years ago patient first noticed pain and tenderness at the epigastrium, which has been worse since January, and is increasing in severity. The pain is paroxysmal, not worse or specially present after food, though occasionally food causes pain. Since January she has vomited frequently. It is years since any blood was brought up. No certainty of loss of weight. On two or three occasions fæces have been blood-stained; never jaundiced. No fulness of epigastrium. Visible peristalsis. General tenderness of abdomen on palpation, but especially over epigastric region. Splashing sounds obtained.

September 28, 1898.—Operation. Extensive adhesions found between gall-bladder, liver, and pylorus. A cicatrix found in the wall of the stomach. There was no stricture of pylorus, but it was found kinked owing to the dilated stomach dragging on the adhesions. Omentum placed between surfaces to prevent further adhesions.

Recovery satisfactory, and patient able to take food well. Later reports satisfactory in every respect.

PYLORIC ULCER; PERIGASTRITIS; ADHESIONS. GASTROLYSIS.

Mrs. M. H., aged forty-one, seen by Mayo Robson with Dr. McGregor Young. For months pain beneath left clavicle and indigestion, with loss of flesh. Recently noticed tumour in upper abdomen. Dilated stomach; movable painless tumour in upper abdomen attached to liver.

Operation. Perigastritis, with adhesions to gall-bladder and liver. Tumour was abnormal; projection from left lobe of liver. Adhesions separated. Very good recovery.

1900.—Health regained.

PERIGASTRITIS; ADHESIONS.

Dr. L., aged thirty-three, seen by Mayo Robson. Ten years ago obstruction of bowels, lasting a week, with vomiting and abdominal colic. Similar attack a few months later; since then subject to bilious vomiting. For two years dyspepsia and flatulence with constipation, but no marked jaundice. For two years pain in right hypochondrium; relieved by taking food. Never vomited blood. Loss of flesh and increasing debility. Well-marked tenderness over gall-bladder and pylorus, with dilatation of stomach.

December 4, 1895.—Operation. Pylorus tucked up to liver and kinked. Adhesions round pylorus separated. No gall-stones present.

Good recovery. By March 3, 1896, had gained a stone in weight.

1900.—Well, and has been engaged in full active work as a medical man in a large country practice ever since he recovered from his operation.

PERIGASTRITIS FOLLOWING CHOLELITHIASIS.

Mrs. M. Z., aged thirty-six, seen by Mayo Robson. 'Spasms' for twenty years. Cholecystotomy in Durban, Natal, ten months ago. Four gall-stones removed. After healing of wound in five weeks return of pain. Pain always after food, and at times vomiting; never vomited blood. Losing flesh rapidly. Dilatation of stomach. No tenderness over gall-bladder.

July 6, 1897.—Operation. Adhesions between pylorus and gall-bladder and liver broken down, and omentum interposed.

July 6, 1898.—Patient writes: 'I now feel a different person, and enjoy perfect health.'

PERIGASTRITIS.

Miss M. S., aged twenty-five, seen by Mayo Robson with Mr. F. H. Mayo, Headingley. Dyspepsia without vomiting for sixteen months; some pain after food. Latterly pain and dragging continuous, chiefly in epigastrium. Loss of flesh. Dilated stomach. Dieting and rest gave no relief. Small ovarian tumour found on pelvic examination under ether.

July 25, 1899.—Operation. Pylorus adherent by long band to right anterior abdominal wall. Adhesions separated. Ovariectomy for tumour performed at same time.

Well February, 1900. Had lost previous troubles and gained weight.

PERIGASTRITIS; CHOLECYSTITIS.

Dr. D. A., aged forty-one, seen by Mayo Robson with Dr. Turner, York. Ill since February, 1898, when he had influenza, followed by scarlet fever in March; in same year repeated similar seizures. At beginning of 1899 was jaundiced for six weeks. Latterly gastric symptoms very prominent. Pain and dragging after food; occasionally vomiting. Lost 2 stones 3 pounds in weight in last sixteen months.

Examination. Rigid right rectus; tenderness below ninth costal margin. No jaundice; dilatation of stomach.

September 22, 1899.—Operation. Extensive adhesions of pylorus and pyloric extremity of stomach to liver and gall-bladder, which was contracted. Gastrotomy and cholecystotomy. Adhesions separated and gall-bladder drained.

Well January, 1900. Regained lost weight, and able to take active service in South Africa.

PERIGASTRITIS.

Dr. M. D., aged forty-nine, seen by Mayo Robson with Dr. McGregor Young, Leeds. Dyspepsia for two years, with progressive loss of weight, to the extent of 30 pounds within the last year. No history of ulceration. Questionable cholecystitis following influenza.

Examination. Rigid right rectus, with little tenderness. Stomach dilated. Patient thin, but not emaciated.

December 7, 1899.—Operation. Many small bands, fixing the pyloric extremity of the stomach to the gall-bladder, and causing a kink in the first part of the duodenum. Separation of adhesions.

Good recovery. Gained 1 stone within two months.

CHAPTER XV

GASTRIC FISTULA

GASTRIC fistula, a sequel of perforation, may be found occasionally on the surface of the abdomen, very rarely in the loin (external gastric fistula), but not infrequently between the stomach and adjoining organs (internal gastric fistula). It may be pathological or traumatic. The following is an etiological classification:

Pathological.—Extrinsic: Cancer of the gall-bladder or bowel; gall-stones; empyema of the gall-bladder; abscess of the liver; abscess of the pancreas; ulcer of the bowel—simple, malignant, or tuberculous; subphrenic abscess bursting into the stomach. Intrinsic: Ulcer of the stomach or pylorus; cancer of the stomach or pylorus; foreign bodies in the stomach ulcerating into neighbouring organs; subphrenic abscess of gastric origin.

Traumatic.—(a) From injury, either by a wound inflicted from without, inwards, or from perforation and escape of a foreign body previously swallowed; and (b) from operation—gastrostomy and gastro-enterostomy.

Ulcer of the stomach is by far the most frequent cause of fistula. It may lead to perforation of the diaphragm, and thence to perforation of the pleura and the lung; to perforation of the pericardium and the heart; to general emphysema, owing to perforation and entrance of air into the mediastinum; as well as to the more ordinary cases of perforation of the skin, leading to surface fistulæ, to perforation of the colon and gastro-colic fistula, to gastro-duodenal, gastro-gastric, and other fistulæ.

The symptoms vary according to the cause and the site of

the fistula. If it be between the stomach and upper bowel, the symptoms may be slight or absent; but if it be between the stomach and the large bowel, the food will pass too rapidly through the alimentary canal, and be parted with before absorption is adequate for nutrition; and, on the other hand, gases from the colon entering the stomach will give rise to foetid eructations, at times to feculent vomiting, and always to chronic dyspepsia.

In a case of fistula between the gall-bladder and stomach, dependent on gall-stones, in a woman of fifty years of age who came under the observation of one of us (Mayo Robson), there was great loss of flesh, with frequent vomiting of bile; for though it is known that healthy bile may pass through the stomach without serious harm to nutrition, the pathological products from an inflamed gall-bladder, together with the infected bile associated with cholelithiasis, seemed in this case to have a very deleterious effect. After opening the abdomen, the fundus of the gall-bladder was found to be firmly fixed to the stomach near the pylorus, and on separating the adhesions the openings into the gall-bladder and stomach were found well within reach. The stomach fistula was closed by two layers of sutures, and then the gall-bladder was brought to the surface and a tube inserted for drainage. The patient made a very satisfactory recovery, and is now quite well, having gained considerably in weight.

In another case of abscess between the liver and pylorus, the stenosis caused by the ulcer produced such serious symptoms of itself that it was difficult to estimate the part played by the abscess. In this case also the ulcer was excised, and the wound stitched up transversely to the pyloric axis, the cavity in the liver being scraped out and purified. The patient is now in excellent health.

In a case of fistula that we found between the stomach and pancreas there was dyspepsia, with pain after food, vomiting, and great loss of flesh; but in this case the stenosis of the pylorus and consequent dilatation of the stomach seemed to account for the greater part of the trouble.

Fistulae on the surface of the abdomen, if small, may

cause little loss of health ; but if extensive, the leakage from the stomach of food and gastric juice leads to great distress from the soreness of the skin around the fistula, and to loss of flesh from the waste of food.

Kronheimer (*Deut. Zeitschr. f. Chir.*, October, 1899) reported a case, verified by post-mortem examination, after an unsuccessful operation. The patient, aged forty-five, was subject to anæmia for nine years ; she had never been pregnant, and the 'periods' ceased for two months. Dyspeptic pains had lasted for some time, and fixed pain was at length localized to a point a little below the left hypochondrium. At length violent vomiting and paroxysmal aggravation of the fixed pain took place. The pain was trifling when the patient fasted. A hard swelling developed at the site of the pain. Five months before admission into hospital it grew red, then soft, and burst a fortnight before ; dark fluid and pieces of food began at once to escape, and the pain diminished. Emaciation was advanced ; the integuments were intensely irritated. Fluids swallowed by the patient escaped in jets through the fistula, and very little nutritive material was digested, hence feeding through the mouth or through the fistula was impracticable. Nutrient enemata were given, but the patient clearly could not be kept alive for long by such means. Hermes undertook an operation for the excision of the fistula, but the patient took the anæsthetic badly, and the heart's action was very weak ; there was also double bronchitis. He therefore, having made a median incision above the umbilicus, did an enterostomy, opening the jejunum directly after its transition from the third part of the duodenum. His aim was to feed the patient through the jejunal fistula till her strength would allow of a more complete operation. This was practicable, but peritonitis set in, and the patient died on the ninth day. A large oval chronic ulcer was found in the anterior wall of the stomach, corresponding to the fistula.

CASE UNDER THE CARE OF MR. C. F. M. ALTHORP

(*Medical Press*, February 6, 1901).

The patient was a woman, aged fifty, who for fifteen months before admission had suffered from abdominal pain and vomiting. On examination she was pale and emaciated. The abdomen was flat. Just below and to the left of the umbilicus was a tender swelling, about 3 inches by 2 inches, in the abdominal wall, the further connection of which could not be determined. In the course of a week an abscess formed at this spot. An

incision was made on October 3, 1900, under an anæsthetic, and a quantity of thin, fœtid pus evacuated. Even at this time it was not obvious what was the cause of the abscess. The wound in the abdominal wall did not heal, and there was found, after a time, a second collection of pus to the left of the former incision. On November 28 this was incised, and found to be rather deeper than the first abscess, but outside the peritoneal cavity. In the course of three days the discharge from the second wound was found to consist largely of gastric contents. In a day or two practically all the food taken escaped by the fistula, and it was thought this indicated some stenosis of the pylorus. The patient was rapidly losing ground.

On December 7 the patient was placed under ether, and the stomach washed out through the fistula, which easily admitted the finger. The peritoneal cavity was opened by an incision above and to the right of the fistula, and a broad pedicle, $3\frac{1}{2}$ inches by $1\frac{1}{2}$ inches, was found passing from the stomach to the abdominal wall. The portion of abdominal wall to which the stomach was adherent was isolated by an oval incision, and sterilized gauze inserted to protect the peritoneal cavity from being soiled. This portion of abdominal wall was then cut away from the stomach. The fistula was found to be the centre of a large ulcer on the greater curvature, near the pylorus. There was no stenosis of the pylorus. The edges of the fistula were freshened, and the opening closed by three rows of silk suture, which, however, had to be passed through greatly indurated tissue. The omentum was drawn over the spot, and fixed there by several points of suture. The abdominal wound was closed by silkworm-gut sutures passing through the whole thickness.

There was great collapse after the operation. Rectal feeding and subcutaneous injections of saline fluid were given with good effect. On the third day small doses of brandy and meat essence were given by the mouth. The patient died on the sixth day, with symptoms pointing to pneumonia.

Autopsy.—Pneumonia of the right lung was found. The abdominal wound was dry, and there had been no escape of gastric contents into the peritoneal cavity. There was, apparently, no attempt at union in the stomach wound, and probably, had the patient survived, a perigastric abscess would have formed. The pylorus was healthy, and not narrowed by the ulcer. There was no dilatation of the stomach. The ulcer was found to be as described at the operation. The omentum was thickened greatly, so as to simulate malignant disease. The report of the microscopic examination showed that there was no evidence of carcinoma.

There are several specimens in the Hunterian Museum. No. 2,531 is a specimen of a cancerous ulcer between the stomach and the colon. The disease probably commenced in the colon. It occurred in a woman of fifty-five years of age. Death was due to exhaustion. There was no vomiting. No. 2,426c is a specimen of cancer of the pylorus involving the transverse colon. It is from a woman thirty-nine years of age.

Diagnosis.

As a rule, except in surface fistulæ, diagnosis can only be made after opening the abdomen; but if unaltered or slightly altered food be seen in the fæces after a history pointing to simple or malignant ulceration of the stomach, a fistula between the stomach and colon would be suspected, especially if fœtid eructations or feculent vomiting occurred from time to time. The inability to distend the stomach with air pumped through an œsophageal tube would help in the diagnosis. The persistent nausea and vomiting of bile was a marked symptom in the gall-bladder-stomach fistula.

Treatment.

In simple internal fistulæ, exploration by abdominal section and closure of the two openings may be done, as in the cases previously referred to. In malignant disease partial gastrectomy and enterectomy might possibly be performed if the disease could be discovered in time; but such a communication would probably mean advanced disease and secondary infection, and would therefore, as a rule, be beyond operative treatment. Surface fistulæ can be closed readily by plastic procedures, if they do not close spontaneously under careful dressing and rest. Such fistulæ may be closed by carefully dissecting, without opening, the peritoneal cavity, and then invaginating the margins of the opening in the stomach, and suturing them accurately together with two layers of superimposed sutures, afterwards closing the muscular and aponeurotic layers of the abdominal wall by separate sutures, and lastly the skin. This operation is sometimes necessary

in closing a gastrostomy opening that has been made for temporary use.

The first attempts to close a gastric fistula were by means of the cautery, and if the fistula be small such means may be quite efficient. In 1859 Middeldorpf introduced a simple plastic operation for the purpose.

In 1877 Billroth cured a patient by completely separating the stomach from its adhesions to the abdominal wall, and then closing the fistula. Esmarch also resected a portion of the stomach wall around a fistula, and closed the opening by sutures. We found in the two cases mentioned of inter-visceral fistulæ that the radical method of separating the fistula from the surrounding adhesions, and then either excising or inverting the raw edges, was attended with satisfactory results. In all cases of surface fistulæ where the fistula is not very small, in which case the cautery will probably cure it, and where it is producing serious or troublesome symptoms, resection should be done, as anything short of this is very likely to fail.

CHAPTER XVI

GASTROPTOSIS

Gastroptosis, or a downward displacement of the stomach, forms one of the prominent characteristics of a disease, often dependent on a congenital deformity, and first described by Glénard of Lyons in 1885, after whom the disease has been named.

In this ailment the ligaments or mesenteries attaching the various organs to the parietes are lengthened, thus allowing the liver to descend below the costal margin, the stomach below the umbilicus, and the intestines, kidneys and other viscera to be more movable than occurs under normal conditions.

Owing to the displacement, kinking of the pylorus or of intestinal loops is apt to occur, leading in the one case to pyloric, in the other to intestinal, obstruction, partial or complete.

Gastroptosis may or may not be accompanied by displacement of the other organs, but whether it occurs alone or as part of a general abdominal slackness, it can readily be recognised by distending the stomach with CO_2 , and by palpating or percussing the outline of the displaced viscera through the abdominal walls.

The accompanying diagram shows the situation of the stomach in the case, of which brief notes are given to illustrate the symptoms that may be expected and the surgical treatment that may be adopted.

The general treatment of Glénard's disease is by means of tonics and rest, with a well-made abdominal belt in order to support and lift up the depressed viscera.

In exceptional cases this is insufficient, and where kinking of the pylorus has led to dilatation of the stomach, with dyspepsia, pain and loss of flesh, operative treatment may be called for.

Duret of Lille was, we believe, the first surgeon to perform gastropexy, which he did by fixing the pylorus and lesser curvature to the abdominal wall. He made an incision

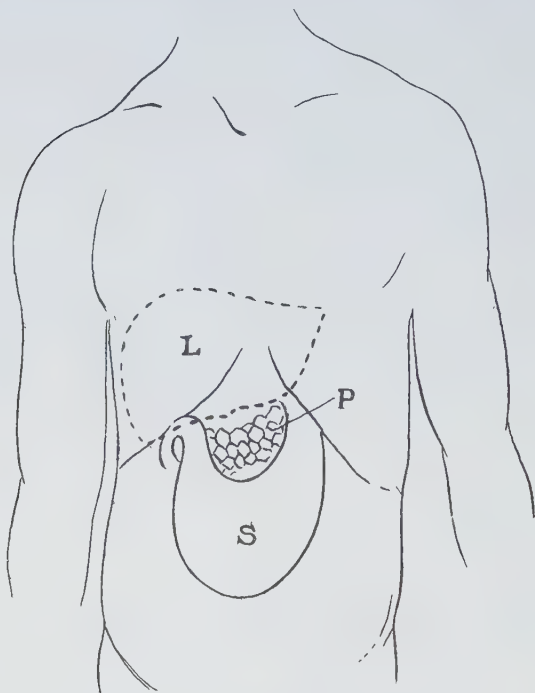


FIG. 47.—GASTROPTOSIS, THE PANCREAS SHOWING ABOVE THE LESSER CURVATURE.

in the middle line above the umbilicus, leaving the peritoneum and transversalis fascia undivided at the upper end of the incision. Sutures were then passed fixing the lesser curvature of the stomach to this undivided fascia, thus correcting the excessive mobility of the organ.

Should there be pyloric stenosis and dilatation, such an operation would be insufficient, and pyloroplasty or gastroenterostomy would be necessary.

Stengel and Beyea (*American Journal of Medical Science*, June, 1899) record a case of Glénard's disease treated by operative procedure.

The patient was a young unmarried woman, without history of injury, abdominal distension or emaciation. At the time of observation she had already undergone nephrorrhaphy, which was followed by some general improvement. It was found, however, that the gastric symptoms remained much as before. Examination of the abdomen showed some sinking in at the epigastrium and a protuberance at the umbilicus, which was found to be the stomach, the lesser curvature extending from $1\frac{1}{2}$ inches above the umbilicus to a point two-thirds the distance from the umbilicus to the pubes, behind which was the greater curvature. The right border extended to the right of the umbilicus $1\frac{1}{2}$ inches, the pylorus being slightly to the right of the middle line and a little above the umbilicus. No evidence of growth could be found. The digestive processes seemed slow. There was no lactic acid reaction. It was decided to operate, and the following was the procedure adopted: An incision was made through the linea alba midway between the xiphoid and umbilicus, exposing a small portion of the upper curvature and cardiac end of the stomach, the gastro-hepatic omentum, the gastro-phrenic ligaments, and the lower portion of the liver. At the beginning of the operation the patient's shoulders were slightly raised, but at this stage the position was reversed to allow the stomach to fall back into position. The gastro-hepatic omentum and gastro-phrenic were exposed, separated from underlying structures, and interrupted sutures were introduced to shorten the gastro-hepatic omentum in the following manner: The first suture caught the gastro-phrenic ligament above at a point as near as possible to the diaphragm (a distance of about 2 inches from the diaphragm) and below, just above the gastric vessels. After this suture had been placed, the gauze sponges which had displaced the stomach were removed and the suture temporarily tightened, so as to determine the height to which the stomach could be brought by this manner of suturing, and the degree of support which would be furnished to the stomach. This having been determined to be satisfactory, the stomach was again displaced out of the wound and the suturing continued. The second suture was introduced through the gastro-hepatic omentum opposite, and about $\frac{1}{4}$ inch from the first one, followed by a row of eight or ten others introduced in the same way, to include the left three-fourths of the gastro-hepatic omentum. In order to be sure of gaining a wide surface of adhesion, particularly in relation with the gastro-phrenic liga-

ment, three or four more sutures were introduced, which included the peritoneum above and below those already placed. The gauze sponges were again removed, and the first and then the second row of sutures were tied, forming a tuck in the gastro-hepatic omentum and gastro-phrenic ligament. After this had been accomplished, the stomach was seen to occupy what was thought to be a normal position. All gauze sponges were then removed from the abdominal cavity, and the table lowered until the patient was in a horizontal position. The patient made an uninterrupted recovery, leaving the hospital in two months and ten days from the time of the operation. Some months later examination showed that the lesser curvature was still well supported, and that the greater did not extend more than $1\frac{1}{2}$ inches below the umbilicus. Eleven months after the operation the woman was found better in every way; she had gained considerably in weight, was able to eat freely without discomfort, appetite and energy being distinctly good.

The authors appear strongly inclined to recommend this operation in cases of gastroptosis in which there are abdominal pain, vomiting, and all the ill-effects due to dilated stomach and disturbed digestion.

CHAPTER XVII

TUBERCLE—SYPHILIS—PHLEGMONOUS GASTRITIS

Tuberculosis of the Stomach.

THE insusceptibility of the mucous membrane of the stomach to become affected with tubercle presents a great contrast to that of the intestinal lining, for primary tubercular ulceration of the stomach is extremely rare, and even secondary tuberculous ulceration is so rare that Dr. M. Simmonds (*Münch. Med. Woch.*, March 6, 1899, p. 317) only found eight specimens among 2,000 tuberculous subjects.

Gastric disorders, however brought about, must be considered among the predisposing causes of tubercular disease, and especially of tubercular disease of the mucous membrane. The ulcers, which may be solitary or multiple, are usually small, with undermined and ragged edges owing to infiltration and breaking down of the submucous tissue, like tubercular abscess in the small intestine.

The following are brief notes of a case on which an operation was performed on account of pyloric stenosis and vomiting due to tubercle affecting the pylorus:

On August 22, 1895, one of us (Mayo Robson) was asked by Dr. J. Lewis Owen, of Llangefni, to see Miss T., aged nineteen, who gave a history of pain after food with occasional coffee-ground vomiting for the preceding four years, though the loss of flesh had only been very pronounced during six months, during which time she had been able to take very little food on account of sickness and pain. Four months before we saw her, dilatation of the stomach due to pyloric stricture had been diagnosed, and lavage of the stomach had been followed out for a month without benefit. She was extremely pale, and so thin that the skin was tightly stretched over her bones. She only weighed 4 stones

10 pounds. Tubercular glands were felt in the neck, and there was a little swelling of the abdomen due to free fluid in the peritoneum. The stomach was markedly dilated, and the pylorus could be felt thickened and movable. As she was clearly going to die unless relieved, operation was performed on August 27, 1895. On opening the abdomen some fluid escaped from the peritoneum. There were tubercular nodules on the stomach and omentum, and the mesenteric glands were found to be full of caseous material and pus. The pylorus was nodular and thickened, and was itself the seat of tubercle; the stomach was enormously dilated.

Pyloroplasty was performed, but before closing the wound in the pylorus the finger was passed into the duodenum, as a constriction could be seen an inch beyond the pylorus. Here was found a stricture that would admit the little finger. Through this a Weiss' dilator was passed, and it was dilated freely until the thumb would readily pass. After the pyloroplasty had been completed the abdomen was closed. The after-progress appeared to be satisfactory, and the wound healed by first intention, the stitches being removed at the sixth day; but no real gain of strength was made, and the patient died exhausted in the second week.

It is the only case of the kind that has come under our care, but Patella (*British Medical Journal*, Suppl., 399, 1900, p. 82), at the Congress on Tuberculosis recently held at Naples, said he had seen three cases of stenosis of the pylorus caused by fibrous peripyloritis developing in individuals who, at least three years previously, had presented symptoms of tuberculous lesions of the lung, which had passed into the phase of obsolescence. In two of the cases gastro-enterostomy had been performed by Golzi and De Pauli, with the result that the patients, who were in a state of extreme marasmus, regained weight and strength. In these cases, in addition to thickening of the pylorus, there were found nodules of fibrous appearance; examination showed that these were not of tuberculous nature. The author affirms that the conditions found gave no ground for the belief that the peripyloritis was tuberculous; he thinks that they are examples of slow sclerosis dependent on tuberculous intoxication, the effect of which may, according to Potain and his school, become manifest in various parts,

especially where (as at the pylorus) there is considerable movement. Whatever be the interpretation of the condition, he urges that in such cases surgical intervention should not be delayed.

Tuberculous ulcers may attain a great size (though this is exceptional), as in one of Dr. Simmond's cases (*Medical Review*, 1900, p. 463), where the ulcer measured 8 inches by 4 inches, its true nature only being recognised on microscopical investigation. It is curious that this ulcer produced no symptoms during life. The occurrence of tuberculous ulcers has been described by Eppinger, *Prag. Med. Woch.*, 1881, No. 51, 52; by Litten, *Virchow's Arch.*, B. 67, p. 615; by Musser, *Philad. Hosp. Rep.*, 1890, vol. i., p. 170; and Blumer, *British Medical Journal*, Suppl., 1898, par. 504.

Petruschky's views as to the tuberculous character of chronic gastric ulcers is not supported either by the clinical experience of these cases treated surgically or by post-mortem evidence. He claims to have diagnosed tubercular ulcers of the stomach by the reaction obtained with tuberculin, which in one case proved curative and in the other palliative. This claim will have to be supported by much clearer evidence than has yet been advanced before it can be received as distinctly proven.

As complications of tuberculous gastric ulcer, hæmatemesis and perforation have been described, but from the chronicity of the ulceration, as well as from the infrequent occurrence of tubercular ulcers, such accidents are extremely rare. Miliary tubercle may affect any of the coats of the stomach, and in this form tubercular disease is by no means uncommon. It was well marked in the case we have described, and is commonly seen in tubercular peritonitis, as well as in other general tuberculous diseases.

Syphilis of the Stomach.

Syphilis of the stomach may occur under the form of ulcer, stricture, or tumour. Some writers regard syphilis as an important factor in relation to gastric ulcer, one author giving the frequency of gastric ulcer as high as 20 per cent. in syphilitic subjects, and others as from 10 to 15 per cent.

Dr. Fenwick ('Ulcer of Stomach,' p. 93), while stating that 10 per cent. of cases of chronic ulcer of the stomach had suffered from syphilis at one time or another, remarks that it is extremely probable that in at least one-half of such cases where the two diseases co-exist in the same patient there is no direct relationship between them. Lesions due to syphilis, having no clinically distinctive features, can only be recognised by the history, the presence of syphilis in other regions, and the result of the treatment.

In the *Philadelphia Medical Journal*, February 3, 1900,

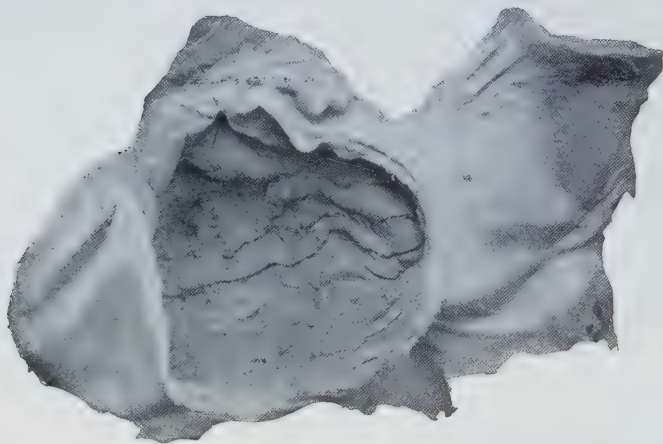


FIG. 48.—CARDIAC ORIFICE OF STOMACH OBSTRUCTED BY A GUMMA, WHICH ALSO INVOLVES THE ADJOINING PORTION OF THE LIVER.

From a gentleman, forty-six years of age, who died of starvation.

p. 262, Max Einhorn gives examples of ulcer, gumma, and pyloric stricture, all of which yielded to treatment by mercury or iodide of potassium. The cases are of sufficient interest and importance to be worth quoting.

ULCER.

CASE I.—A woman, aged thirty, had for three months suffered from violent pains immediately after meals, and occasional vomiting. The ordinary treatment of gastric ulcer had failed. She had acquired syphilis three years previously, and had recovered under mercurial inunction.

There were violent pains after taking even fluids, such as milk, bouillon, etc. The pains lasted for one or two hours, and were

sometimes attended by vomiting. There were pains in the lower limbs, which were more marked at night, and the tibiæ were tender. Syphilitic ulcer of the stomach was diagnosed. Mercurial inunctions were employed, and iodide of potassium was given. After fourteen days the pains disappeared, and solid food could be taken. Recovery was complete at the end of six weeks.

CASE 2.—A woman, aged thirty-three, had acquired syphilis at twenty-six. Pains after eating had existed for two years. Profuse hæmatemesis had occurred. Under treatment for gastric ulcer she recovered, except that she did not regain her former health, and complained almost constantly of dyspeptic symptoms. A short time before she came under observation, a second severe attack of hæmatemesis, accompanied by melæna, occurred.

The patient was extremely anæmic and confined to bed. There were constant pains in the stomach, which radiated towards the back, and were increased even by liquid foods. During six weeks fluid diet and bismuth were prescribed. The vomiting ceased, but the pain persisted. Iodide of potassium was then given. In a few days the pains diminished; after three weeks they had disappeared, and ordinary diet could be taken. Permanent recovery ensued.

GASTRIC TUMOUR.

CASE 1.—A woman, aged thirty-five, had contracted syphilis at thirty-three. For six months she had had pains after meals, and occasional vomiting. A nodular tumour about the size of a goose-egg was felt under the left costal margin. It was beneath the abdominal wall, and moved on deep inspiration. Below the tumour a splashing noise could be elicited. The gastric region was tender. In the back a tumour of bony hardness extended from the third to the sixth dorsal vertebræ. The presence of this tumour and the history led to the diagnosis of gumma of the stomach, although the nodular gastric tumour was suggestive of cancer. Under inunction and iodide of potassium improvement took place, and in a few weeks both tumours disappeared.

CASE 2.—A man, aged fifty, had acquired a chancre at thirty-two, and for eighteen years had had severe gastric troubles, anorexia, and sleeplessness. Three years previously abdominal pains began, and he lost 15 pounds in weight. In the epigastrium a slight oval resistance was felt over an area the size of a hen's egg. Under iodide of potassium he regained weight, and the tumour disappeared.

PYLORIC STRICTURE.

A man, aged thirty-seven, had acquired syphilis at thirty, for which he was treated for several months. After four years dyspeptic symptoms began. He was attacked with pains some time after eating, and occasionally with vomiting. During the last year he had lost 30 pounds in weight, the symptoms became much worse, and he lived chiefly on liquid food. He had to wash out his stomach two or three times daily, otherwise the pains became unbearable.

He was weak and emaciated. The stomach was dilated, extending to the symphysis pubis. Gastric peristalsis was visible. An oval tumour larger than a pigeon's egg was felt in the mammary line under the right costal border. Under fluid diet, resorcin, and bismuth, the pain and vomiting, after fourteen days, diminished, but the tumour remained unchanged. Iodide of potassium, 10 grains, three times a day, was then given. After another fourteen days the tumour had diminished, the pains had almost completely disappeared, and the vomiting no longer occurred. A month later the tumour could not be felt, and the patient's condition was improved. He was soon able to take solid food, and in four months he gained 20 pounds in weight.

Dieulafoy (*Bull. de l'Académie de Méd.*, p. 578, 1898) published a case in which the symptoms of ulcer of the stomach resisted all ordinary methods of treatment for eighteen months, and then yielded rapidly to biniodide of mercury. G. Andral, in 1834, described two cases (*Medical Review*, March, 1900, p. 154). In one, a woman, aged twenty-nine, lost appetite, was tormented with pains after meals, and frequently vomited. During three months all kinds of treatment failed. Pains in the neck on swallowing were then complained of, and a number of ulcers of syphilitic appearance were discovered in the pharynx. The question then arose, Were there similar ulcers in the stomach? Under mercury recovery took place in a few weeks.

Virchow, Klebs, Birch-Hirschfeld, Dalglish, and others, have also described isolated cases.

Dr. Simon Flexner (*American Journal of Medical Sciences*, October, 1898) contributes a valuable article on this subject. The literature is very meagre; he could find only fourteen reliable cases, of which thirteen were German and one

French. According to him, there is no instance recorded in the English language. This is scarcely correct. In the *British Medical Journal*, 1891, ii., p. 696, Dr. J. Keser has recorded the case of a young woman treated at the French Hospital, the subject of secondary syphilis, who had all the symptoms of gastric ulcer. She was treated with bismuth and nitrate of silver, and fed by the rectum; but only temporary improvement took place, and the hæmatemesis continued. Various drugs were tried without success. The constitutional disease was then discovered, and the patient at once improved under specific treatment. The subject has recently attracted the attention of clinicians. M. Dieulafoy discussed the subject at the Académie de Médecine on May 17. He concluded that gastric syphilis is not so uncommon as is supposed, and that, as the symptoms differ in no way from those of simple ulcer, a history should be sought in every case. In *La France Médicale*, July 1, 1898, Dr. Dubec has published the case of a man, the subject of tertiary syphilis, in whose stomach an indurated plaque could be felt, which diminished rapidly under mercury and iodide of potassium. The Transactions of the Pathological Society of London do not contain a single reference to the subject. Of the fourteen cases, five were of the inherited, and nine of the acquired, form. The lesions found were gummata, ulcers, and cicatrices, and were usually accompanied by syphilitic disease of other viscera, and sometimes by intestinal ulcers. All the acquired cases appear to have been in the tertiary stage, but some of the congenital occurred in new-born infants. Chiari paid special attention to gastric syphilis. In 243 necropsies where syphilitic lesions were found there were two cases of gastric syphilis.

Dr. Flexner records the case of a man, aged fifty-two, whose illness extended over three years. He had severe vomiting, following on a drinking bout. The spleen was enlarged, ascites appeared, and then anasarca of the legs and scrotum. He was repeatedly tapped; $3\frac{1}{2}$ gallons of fluid were withdrawn on the first occasion. The liver was hard, but there was no increase of the area of dulness. Before death he suffered from intense abdominal pain and

tympanites. The necropsy showed old adhesions between liver, stomach, spleen, and pancreas; the liver gummatous and its capsule thickened; perforating ulcer of the stomach; the spleen enlarged and its capsule cartilaginous.

It will be seen that from a surgical point of view the subject is of great importance, since it would be easy to mistake a gummatous tumour of the stomach or pylorus for cancer, and perform gastrectomy when simple medical treatment would do all that is required. The lesson to be learnt is that inquiries with regard to syphilis should always be made in ulcer or tumour of the stomach, and antisiphilitic treatment should be given a trial before resorting to more radical surgical means.

But while the question of syphilis is to be borne in mind, it must not be forgotten that gummata of the stomach are extremely rare even in cases of congenital syphilis, and that too much time must not be lost in medical treatment in a doubtful case, lest the disease advance too far for surgical treatment to be of service.

Phlegmonous Gastritis.

Phlegmonous gastritis is seen in two forms: the diffuse and the circumscribed.

The **diffuse** form is an exceedingly acute and an invariably fatal disease. There is no record of any case having recovered, though two museum specimens of Dittrich's are considered as showing that recovery is possible. The symptoms are: sudden onset of epigastric pain, tenderness and rigidity over the stomach, vomiting of bile-stained fluid chiefly, high temperature, extreme weakness and restlessness, acute peritonitis, delirium and coma. The mean duration of life is six and a half days.

At a meeting of the American Medical Congress in May, 1900 (*British Medical Journal*, Suppl., 1900), Kinnicutt of New York showed a specimen from a case of acute phlegmonous gastritis.

The patient was a man, aged forty-one years. There was no history of syphilis, but the patient was an alcoholic. The disease followed a drinking spell, and was ushered in by vomiting, first

of food, and later of a brownish fluid. There was abdominal pain, constipation, dry tongue, shallow respiration, 48 per minute, regular pulse, 108 per minute, restlessness, and an anxious expression. The temperature was 101° in the rectum. The physical examination was negative, except for a slight hypertrophy of the left ventricle. The abdominal walls were rigid and deep; palpation was sensitive in the epigastric and left hypochondriac regions. There was crepitation beneath the left costal cartilages. The urine contained casts. The patient grew progressively worse, and surgical intervention was deemed inadvisable. At the necropsy the organs were normal, except for the hypertrophy of the left ventricle of the heart, before alluded to. The peritoneum presented a slight sero-fibrinous exudate. The stomach wall was thick, especially at the pyloric end. The thickening was due to a purulent infiltration of the submucous coat, with a yellowish exudate. There was a linear cicatrix on the posterior wall of the stomach, near the pylorus, on which was a necrotic area. The endothelium was desquamated on the serous coat. The muscle was invaded by mononuclear leucocytes. The submucosa was swelled to four or five times its normal thickness, and contained leucocytes and micro-organisms. The lymphatics contained bacteria. The necrotic area in the scar had nearly exposed the submucosa, and was possibly the point of infection. The streptococcus was found throughout the stomach. The bacilli in the lymphatics were possibly of post-mortem origin.

In the discussion, W. H. Welch stated that he had seen a similar case, in which there was a fibrino-purulent peritonitis. The patient was an alcoholic. The pus was found principally in the submucous coat of the stomach. E. G. Janeway had seen three primary cases and two secondary cases. One of the patients was not a drinking man, and the two secondary cases followed sepsis, and were local in their areas of involvement.

The **circumscribed** form leads generally to abscess in the wall of the stomach. The symptoms are : intense epigastric pain and tenderness appearing suddenly, but gradually lessening in their acuteness. There is an irregular elevation of temperature, and vomiting is a prominent symptom. The illness lingers, and the patient becomes sallow, pinched, and wasted. A tumour of rounded form may be observed, and the vomiting of pus. In one example a pint of pure pus was

vomited in the presence of the physician. In others the vomiting of pus gave relief, and the illness passed off.

Stiedel (*Deut. Zeit. für Chir.*, 56) has related the occurrence of phlegmonous gastritis spreading from a pyloric ulcer, and leading to purulent peritonitis, after gastro-enterostomy, when the suture line was found intact and soundly healed.

Treatment.—Surgical intervention in cases of circumscribed gastritis leading to the formation of abscess is clearly indicated. The diagnosis, however, is so uncertain that few opportunities of treating such cases will be found.

CHAPTER XVIII

OPERATIONS UPON THE STOMACH

Gastrostomy.

THE purpose of this operation is to form an artificial opening into the stomach, to permit of food being administered when the œsophagus is rendered impassable by stricture.

The operation was first suggested in 1837 by Egeberg, a Norwegian military surgeon. He spoke of the possibility of

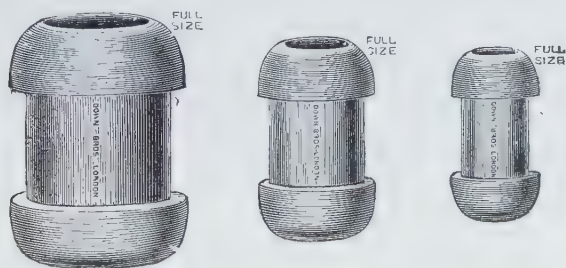


FIG. 49.—MAYO ROBSON'S BONE BOBBINS.

making 'an opening into the cavity of the stomach, either for injecting a sufficient quantity of food or for attacking an œsophageal stricture from below.'

The cases of Voigtel and Beaumont had shown that a gastric fistula was compatible with life, and experiments performed upon dogs by Blondlot ('*Traité Analytique de la Digestion*,' 1843) suggested the possibility of successful operations upon man. The first operation was performed on November 13, 1849, by Sedillot, the patient dying in a

few hours. In 1875 Sydney Jones, who had twice operated without success, performed a gastrostomy upon a patient who survived twenty days; and in 1876 Verneuil operated upon a patient who lived sixteen months. In Sedillot's first operation the stomach was opened immediately; in his second an interval of five days was allowed to elapse between the fixing of the stomach to the abdominal wall and the opening of the stomach. This, the first operation *à deux temps*, was performed on January 21, 1853.

The variety of methods suggested for opening the stomach is almost bewildering. All the methods which now find

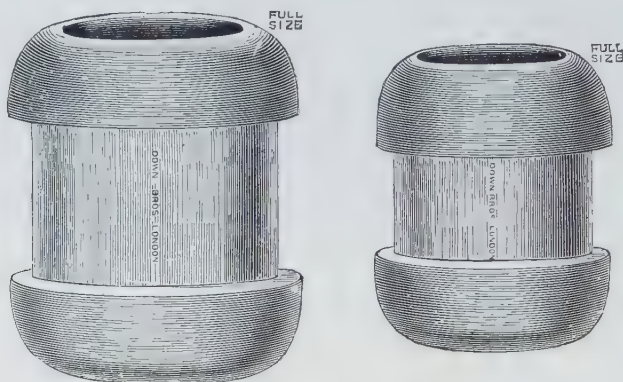


FIG. 50.—MAYO ROBSON'S BONE BOBBINS (LARGER SIZES).

favour have as their chief principle the formation of a valvular orifice, so that fluid is readily introduced into the stomach, but is unable to escape from it. The evils which result from the dribbling of the gastric juice on to the surface of the abdomen are intolerable. The skin is digested, is of a vivid red colour, and looks angry and florid. The pain is described as unendurable, and the patient welcomes death as a release from suffering. With any one of the modern operations a leakage should never occur.

The operations which we consider the most satisfactory are:

1. Frank's operation.
2. Senn's operation.
3. Witzel's operation.
4. Kader's operation.

1. **Frank's Method** (*Wien. Klin. Woch.*, 1893—variously described as 'Ssbanajew-Frank's,' 'Albert-Frank's,' or 'Albert-Frank-Kocher's').—We have employed this method in a large number of cases, and are eminently satisfied with it. When the patient is much reduced in strength, the

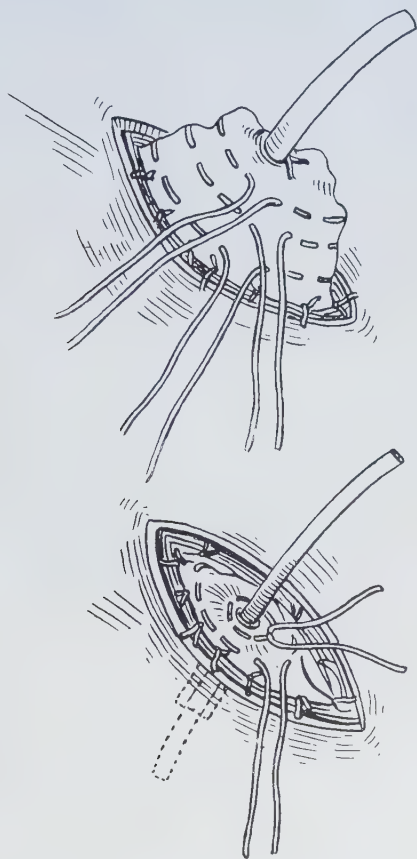


FIG. 51.—GASTROSTOMY. (SENN'S METHOD.)

anæsthesia of cocaine is quite sufficient, a general anæsthetic not being necessary. The following modification of the original procedure, first suggested and adopted by Mayo Robson, is employed :

A vertical incision of about $1\frac{1}{2}$ inches is made over the

outer third of the left rectus abdominis, commencing $\frac{3}{4}$ inch below the costal margin; the fibres of the rectus are separated, but not divided, to the extent of the incision, and the posterior part of the rectus sheath and peritoneum are divided together, the opening being an inch in length. A portion of the cardiac end of the stomach is then brought up through the wound and held forward by an assistant until

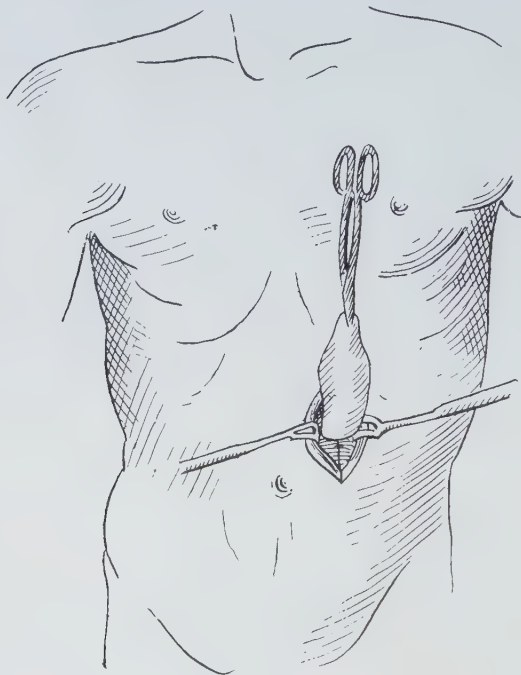


FIG. 52.—GASTROSTOMY. (FRANK'S METHOD MODIFIED.)

four sutures are inserted into the base of the cone by means of a curved intestinal needle, so as to fix the visceral peritoneum of the stomach to the edges of the parietal peritoneum. A transverse incision of $\frac{1}{2}$ inch is then made through the skin 1 inch above the upper end of the first cut, and by means of a blunt instrument, such as the handle of a scalpel, the skin is undermined so as to connect the two openings beneath a bridge of skin and subcutaneous tissue. A closed

pair of pressure forceps is introduced through the upper incision as far as the projecting part of the stomach, and made to grasp the most prominent part, which it draws up to and beyond the surface of the second opening, where it is retained by means of two hare-lip pins. It should just fill the opening, and should require no sutures. The lower opening is now closed by two or three silkworm-gut sutures

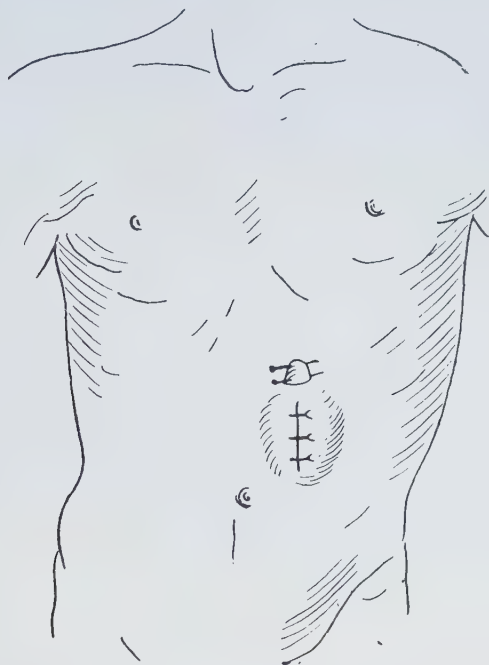


FIG. 53.—GASTROSTOMY. (FRANK'S METHOD MODIFIED.)

or by a continuous stitch, and the edges are dried and covered with collodion and gauze. If needful, the stomach can be opened at once by a tenotomy knife introduced between the pins; but, if possible, the opening should be deferred for twenty-four hours, when a barrier of lymph will have been thrown out. After opening the stomach, a soft catheter, from a No. 8 to No. 12, is inserted, to which a piece of tubing is fixed, and by means of a funnel the patient

can at once be fed with warm milk and egg, or whatever liquid may be thought desirable. The catheter may be left in position for a few days, after which it is easy to insert it whenever a meal is required.

2. **Senn's Method** (*Journ. Amer. Med. Assoc.*, 1896).—The stomach being exposed, an incision about $\frac{1}{4}$ inch in length is made into its cavity as near the cardia as possible,

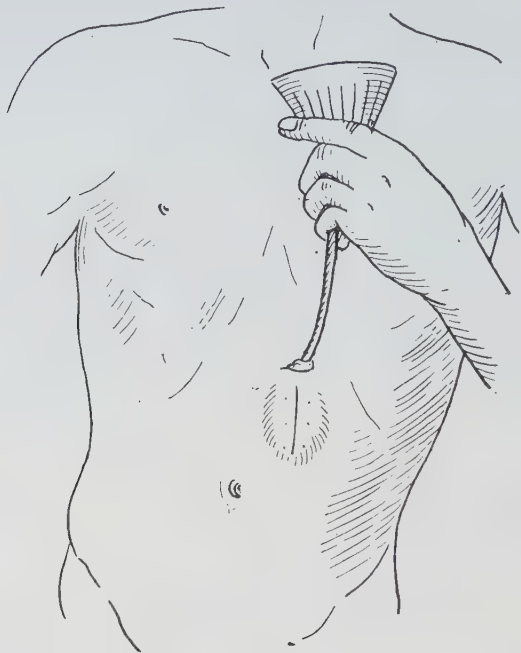


FIG. 54.—GASTROSTOMY. (FRANK'S METHOD MODIFIED.)

and midway between the greater and lesser curvatures. A tube equal to a No. 12 or 14 catheter is now introduced into the stomach, and there fixed by a suture, which includes the cut edge of the stomach and the side of the tube. In order to infold the tube in the stomach wall, a purse-string suture is passed round the tube at a distance of $\frac{1}{2}$ inch from it. The tube is pushed inwards towards the stomach cavity while the suture is tied. A second purse-string suture, and then a third, are passed and tied in the same manner. The result is

that the tube lies in a funnel-shaped inverted portion of the anterior wall of the stomach, and is there fixed by the sutures placed one above the other. The stomach is now fixed to the anterior abdominal wall by a suture above and a suture below the tube, and the abdominal incision is closed in the usual manner. The advantage of this method over Frank's lies in the fact that, as the portion of the anterior stomach wall used for the purpose of effecting a valvular action is pushed inwards instead of being dragged outwards, a larger cavity is left for the reception of food, and the area of the gastric mucosa brought into contact with the food is therefore more extensive.

3. **Witzel's Method** (*Cent. für Chir.*, 1891).—Fenger's incision, parallel to the costal margin, is made until the rectus muscle is reached. The fibres of the muscle are split vertically, and the peritoneum opened. The stomach is exposed and drawn out of the wound; a small incision is made into the stomach, a tube introduced and fixed by a single catgut suture. The tube is then laid upon the stomach wall for a distance of 2 inches or rather more, and a gutter is made for it by raising up a fold on each side and stitching the folds over the tube. The tube then opens into the stomach 'in the same manner as the ureter opens into the bladder.' The stomach is fixed to the abdominal wall by two or three sutures. Mikulicz and Helferich have shown that after the lapse of a few months the oblique passage for the tube becomes a direct one, the inner orifice lying behind the outer.

4. **Kader's Method** (*Cent. für Chir.*, 1896).—The stomach is exposed through Fenger's incision, a cut is made into it, and a tube introduced and fixed by a single catgut stitch. Two parallel folds of the stomach are then raised up, one on each side of the tube, and their summits are sutured by two or three Lembert's sutures above, and the same number below, the tube. The sutures are cut short. Two similar parallel folds are again raised up and again stitched, and, if necessary, a third tier is added. A most efficient valve is thus formed. The stomach is fixed by one or two sutures to the anterior abdominal wall.

In the three last methods a tube, closed by a clip or a safety-pin, should always be kept in the stomach, as the openings so readily contract.

The following is a complete list of our cases of gastrostomy :

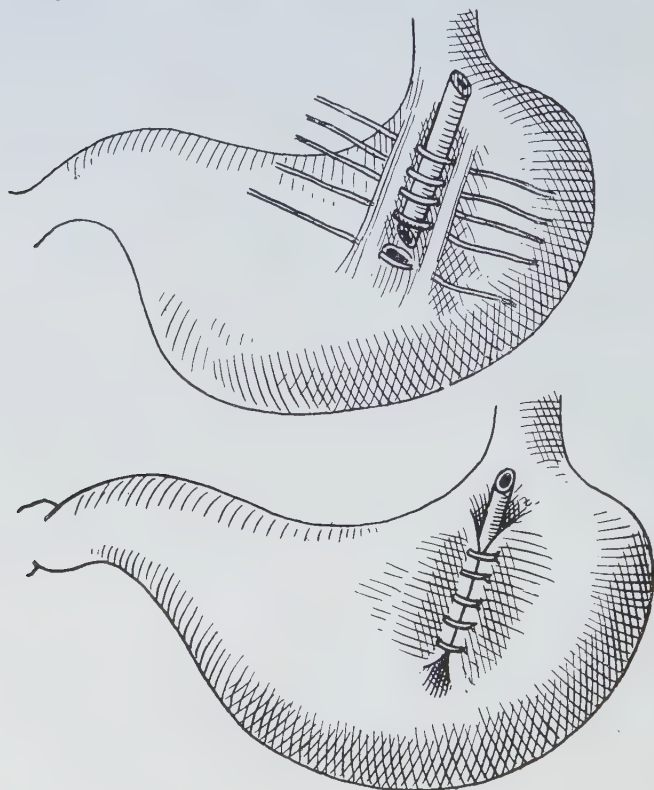


FIG. 55.—GASTROSTOMY. (WITZEL'S METHOD.)

CASE 1.—Mr. J. F., aged fifty. Seen at infirmary. Cancer of œsophagus. Very feeble. Operation March 24, 1884. Died fifth day.

CASE 2.—Mr. C. L., aged fifty-three. Seen at infirmary. Cancer of œsophagus. Operation April 25, 1884. Died seventh day.

CASE 3.—Mrs. A. D., aged fifty-one. Seen at infirmary. Cancer of œsophagus. Operation August 19, 1885. Died seventh day.

CASE 4.—Mr. T. O., aged fifty-one. Seen at infirmary. Five months' symptoms. Cancer of œsophagus. Operation May 30, 1889. Recovery. Gained $1\frac{1}{2}$ stones. Lived a year and three months.

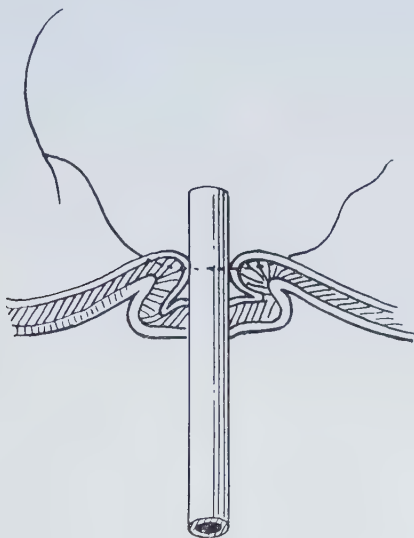


FIG. 56.—GASTROSTOMY. (KADER'S METHOD.)

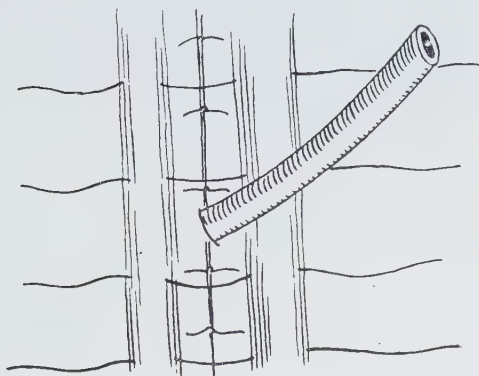


FIG. 57.—GASTROSTOMY. (KADER'S METHOD.)

CASE 5.—Mr. D. P., aged sixty-four. Seen at infirmary. Cancer of œsophagus. Patient almost moribund. Operation November 7, 1894. Died second day.

CASE 6.—Miss F. W., aged forty-six. Seen with Dr. Hick.

Malignant disease high in œsophagus. Operation February 2, 1895 (Greig Smith's method). Tracheotomy necessary also. Lived five months.

CASE 7.—Mr. W. H., of Burnley, aged forty-eight. Seen at infirmary. Dysphagia. Loss of weight from 9 stones 10 pounds to 7 stones 13 pounds in six months. Operation September 10, 1895. Recovery. Living a year later.

CASE 8.—Mr. W. B., aged sixty-four. Seen at infirmary. Cancer of œsophagus. Operation May 15, 1896. Died fifth day.

CASE 9.—Mrs. E. H., aged forty-three. Seen at infirmary. Cancer of pharynx. Operation October 3, 1896 (modification of Frank's method). Recovery. Lived two months, and had tracheotomy for cancer of larynx.

CASE 10.—Mr. C. N., of Brighouse, aged fifty-eight. Seen at infirmary. Dysphagia two months. Hoarseness two months. Operation January 28, 1897. Recovery. Out-patient February 16.

CASE 11.—Mr. M., aged fifty-seven. Seen with Dr. Herbert Robson. Cancer of pharynx. Inability to swallow. Operation April 24, 1897. Recovery. Lived some months, and had tracheotomy done June 11, 1897.

CASE 12.—Mrs. G. L., aged thirty-two. Seen at infirmary. Dysphagia two years. Weight 6 stones. Operation July 16, 1897. Recovery. Out-patient August 6.

CASE 13.—Mrs. B. W., aged fifty. Seen at infirmary. Dysphagia seven months. Lost 5 stones. Operation June 3, 1897. Recovery. Out-patient June 11 at own request.

CASE 14.—Mr. F., aged forty-nine. Seen with Dr. Carter, Starbeck. Cancer of œsophagus. Dysphagia 11 months. Operation January 18, 1898. Recovery. Lived several months.

CASE 15.—Mr. J., aged forty-eight. Seen with Dr. Marshall of Halifax. Cancer of œsophagus. Operation October 25, 1898. Recovery.

CASE 16.—Mr. W. H., aged sixty-six. Seen with Dr. Milne of Mirfield. Operation September 8, 1899 (Frank's method). Carcinoma near cardia. Died November, 1900.

CASE 17.—Mrs. F. A. R., aged sixty-three. Seen at infirmary. Carcinoma near cardia. Operation September 19, 1899 (Kader's method). Recovery. Seen eight and a half months later. Since lost sight of.

CASE 18.—Mrs. E. B., aged fifty-two. Seen at infirmary. Carcinoma near cardia. Operation September 20, 1899 (Kader's method). Almost moribund. Lived twenty-two days.

CASE 19.—Mr. B., aged eighty-six. Seen with Dr. Bevan Lewis of Wakefield. Three years' history of dysphagia. Operation October 19, 1899. (Cocaine anæsthesia.) Recovery.

CASE 20.—Mrs. B., aged fifty-three. Seen with Dr. Sharpe of Matlock. Stricture of œsophagus. Operation March 29, 1900. Recovery. Before leaving home gained 5 pounds; later considerable gain in weight. Living a year later, and said to be well.

CASE 21.—Mrs. N. P., aged forty-two. Seen at infirmary. Eight months' dysphagia. Lost 1 stone between February and April. Operation April 10, 1900. Recovery. Out-patient June 15.

CASE 22.—Mr. C. T., aged fifty-one. Seen with Dr. Tyrie. Carcinoma near cardia. Operation June 14, 1900 (Senn's method). Recovery.

CASE 23.—Mr. G. S., aged fifty. Seen at infirmary. Carcinoma lower end of œsophagus. Operation August 6, 1900 (Senn's method). Recovery. Still living.

CASE 24.—Mrs. E. H., aged fifty-six. Seen at infirmary. Carcinoma lower end of œsophagus. Operation September 17, 1900 (Senn's method). Recovery. Still living.

CASE 25.—Mr. P., aged fifty-four. Seen with Dr. Knight of Keswick. Stricture of œsophagus. Four months' dysphagia. Operation April 4, 1901. Recovery.

CASE 26.—Mrs. H., aged fifty-five. Seen with Dr. Horne, Barnsley. Extreme weakness. Cancer of cardiac orifice of stomach. Operation April 15, 1901. Recovery.

From this list it will be seen that since January, 1897, we have had no death from the operation. Total—26 cases, 5 deaths.

Pyloroplasty.

Pyloroplasty was first performed in 1886 by Heineke, in 1887 by Mikulicz. The stomach being exposed, the pylorus is drawn into the wound and protected well with sponges. The stricture is then divided transversely by an incision which must extend at the least 1 inch on each side of it. This incision may be commenced from the stomach side, and prolonged towards and into the duodenum either by scissors or by a scalpel guided along a director passed through the constriction. Nibbed forceps are then applied to the middle of the upper and lower lips of the incision. On pulling these upwards and downwards the transverse incision becomes longitudinal, and in this position it is sutured. Two layers of stitches are applied, both continuous. The mucous membrane is stitched with catgut,

and the peritoneum with silk or celluloid thread. The operation may be modified by introducing a bone bobbin as an internal splint, and suturing over this.

The important point in the operation, necessary for success, is the making of the dividing cut of ample length. As our experience of pyloroplasty increases, we are inclined to place less reliance upon it as a therapeutic measure. In certain of our own cases, and in those of our colleagues, cases which have been brilliantly successful in their immediate results have shown after the lapse of eighteen months, two years, or longer, a tendency to relapse. In none of the cases has there been a complete return to the original condition, but symptoms of the same kind, though less in degree, have been observed.

Pyloroplasty must not be performed where there is active ulceration or moderate or extensive induration, or adhesions the result of peripyloritis. In those cases where narrowing of the outlet occurs after pyloroplasty it is probable that the operation has been contra-indicated from the first, though experience to guide us at the time was lacking. As the prohibitive restrictions we have mentioned are present in the majority of cases, it necessarily follows that the rôle of pyloroplasty is a limited one. Though this opinion is contrary to that of many surgeons, we feel convinced that it will be shared by all who can watch for years the careers of their patients. Berg (*British Medical Journal*, August, 1900) has abandoned pyloroplasty for gastro-enterostomy in cases of pyloric stenosis on account of this tendency to recurrence of the stricture. Pyloroplasty will be chiefly of service in cases of string-like narrowing or in spasm of the pylorus.

Gastroplasty.

Gastroplasty was first performed by Wölfler in 1894 for hour-glass stomach. The operation tallies in all its details with pyloroplasty. The incision dividing the isthmus should be of a minimum length of $3\frac{1}{2}$ to 4 inches. Illustrative cases are mentioned in the chapter dealing with Hour-glass Stomach.

Gastro-gastrostomy, or Gastro-anastomosis.

This operation was first performed by Wölfler. A modification of the original procedure was adopted by Francis S. Watson in 1895.

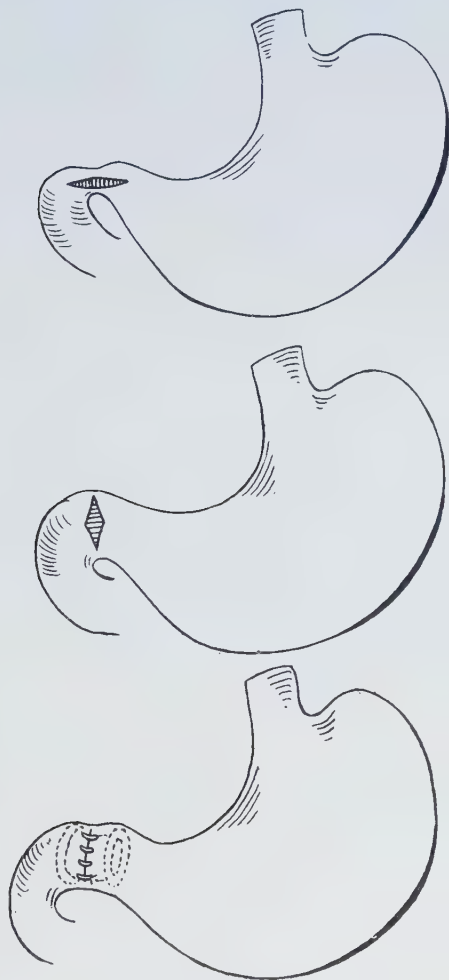


FIG. 58.—PYLOROPLASTY.

The operation is suited to those cases of hour-glass stomach in which the sagging of the stomach on each side

of the constriction permits of an anastomotic opening being made in each complement of the stomach.

The stomach being isolated by means of sponges or gauze, the contiguous sides of the two halves of the stomach are placed in apposition. Into each cavity a vertical incision is made of the greatest length possible. The incision should extend from just below the constriction to the greater curvature of the stomach, and is carried through the serous and muscular coats until the mucous membrane bulges outwards.



FIG. 59.—GASTROPLASTY WITH THE AID OF MAYO ROBSON'S BOBBIN.

An ellipse of mucous membrane is then removed as advised by Moynihan in gastro-enterostomy. Bleeding is free and occurs from many points.

The two openings are now united by continuous sutures, an outer of silk or celluloid thread for the serous coat, and an inner of catgut for the mucous coat, or for the whole thickness of the stomach wall—preferably the latter.

The largest-sized bone bobbin may be introduced as an internal splint whereon to stitch.

Watson's Method.—This operation is described by its

originator in the *Annals of Surgery*, July, 1900. The steps of the operation were as follows: The pyloric portion was raised and turned over on to the cardiac, the constriction being used as a hinge, thus making it, the hitherto injurious feature, become a useful technical agent. The next step consisted in uniting the two parts of the stomach to each other in the position just described and previous to making the communicating opening, the object being to defer doing the latter until the end of the operation, in order to avoid spilling the stomach contents into the peritoneal cavity. This union was accomplished by means of a single line of fine silk sutures passed through the serous and muscular coats of the two halves of the organ, and uniting them by a portion of their surfaces, having an elliptical form and measuring $3\frac{1}{2}$ inches in length by about $1\frac{1}{2}$ inches in width. One suture was left long at each side of the two ends of the ellipse in order that the limits of the sutured area might be defined by traction upon them at the moment of making the communicating openings, as will be seen later. The two compartments of the stomach being thus attached to each other, there remained but one way to gain access to that part of their surfaces which was held in apposition within the elliptical line of sutures, and through which the communicating openings must be made, and that way was through the presenting surface—the roof, so to speak—of the pyloric compartment. This was accordingly done by a short incision through that part. The edges of this incision being held up by tenacula and the contents of the pyloric chamber being sponged out, there was no soiling of the peritoneum by it. Traction was now made on the four long sutures, and the length and breadth of the sutured ellipse was thereby at once defined, and its surface was, moreover, made tense. A scalpel was passed through the walls of both chambers of the stomach at a point close to one end of the ellipse and carried to its opposite end, thereby establishing communicating openings between the two halves of the stomach by incisions through the walls of both, which incisions, being made by one and the same stroke of the knife, necessarily corresponded exactly in all respects. The

cuts lay in the direction of the long axis of the stomach, midway between its greater and lesser curvatures, and were about 3 inches long. A widely-spaced buttonhole suture was applied over the edges of the incisions, to avoid their opposite sides uniting. Closure of the wound in the roof of the pyloric half of the stomach completed the operation.

The advantages of this method over Wölfler's are not apparent, and, as it is more cumbersome and takes longer in the doing, we do not counsel its adoption.

Gastro-enterostomy.

In this operation an anastomosis is made between the stomach and the small intestine. It was first suggested by Nicoladoni in 1881.

Gastro-enterostomy may be performed in one of two ways. The jejunum (the portion of bowel usually selected) may be joined either to the anterior (Wölfler's method) or to the posterior (Von Hacker's method) wall of the stomach.

Each operation has its own advocates. We have more frequently and latterly adopted the posterior operation. Mikulicz, whose experience is considerable, has abandoned the posterior method for the anterior, while Carle in malignant cases has abandoned the anterior for the posterior. The chief advantage of the posterior over the anterior is claimed to be that the opening is at a more dependent portion of the stomach, and therefore, while the patient lies upon his back in bed after the operation, the stomach contents will the more readily drain into the intestine. When the junction is made on the anterior surface, however, the traction of the lesser bowel brings the anastomosis to the lowest point of the stomach, as may be seen after the viscera are replaced, or especially when the parts are examined, if death follows some weeks or months after the operation. Under such circumstances, the opening is seen to be at the apex of a funnel-shaped portion of the stomach. It is said that regurgitation of bile and pancreatic juice is less likely to occur after the posterior operation, but the evidence on this point is not satisfactory. It is now proved

beyond question that in all cases of gastro-enterostomy a regurgitation of these juices into the stomach occurs constantly. Neither secretion in the least affects the digestion of food, as has been shown by Dastre, Oddi, Moynihan, and others.

Our own decided preference is for the posterior operation. In our earlier cases we both adopted the anterior method, but our later operations have all been carried out by Von Hacker's method, and the results have been excellent. Sickness after the first few hours is almost unknown, having only occurred to a trivial extent in two cases. In feeble patients with a tendency to hypostatic changes in the lungs the bed-rest may be allowed from the first.

Technique.—The abdomen is opened by an incision 4 inches long in the middle line, or near it, above the umbilicus. The stomach is thus exposed. The jejunum is readily found by turning the omentum and transverse colon upwards, locating the inferior duodenal fold or the last portion of the duodenum, and so seizing the first portion of the jejunum. A point about 12 inches from the duodeno-jejunal angle is chosen for the anastomosis in the anterior operation, less than this for the posterior operation. A loop is drawn out, milked until empty, and encircled with an elastic ligature, care being taken that the proximal end of the loop is towards the cardiac end of the stomach. The union of the viscera can be effected outside the abdomen, sponges or strips of gauze being packed round to isolate the operation area. In the **anterior** operation the point selected on the stomach for the incision is near the pylorus, and as close to the greater curvature as possible. After the suture of the two orifices is complete, a few additional stitches are introduced into the proximal end of the loop, securing it at a higher level on the stomach wall and into the distal, and securing it at a lower level, in order to obviate kinking. In the **posterior** operation the transverse colon and great omentum are pulled upwards, exposing the under-surface of the transverse mesocolon. A small slit is made in this antero-posteriorly, and enlarged with the fingers, care being taken scrupulously to avoid the wounding of any vessel. The posterior wall of the stomach is thus

exposed, and may be held in position by the pressure of an assistant's hand from above. The lateral margins of the incision in the transverse mesocolon are stitched on each side to the stomach by a single suture, in order to prevent closure of the slit and consequent narrowing of the jejunum, as noticed by Czerny. The union of the viscera may be effected in both anterior and posterior operations in one of three ways :

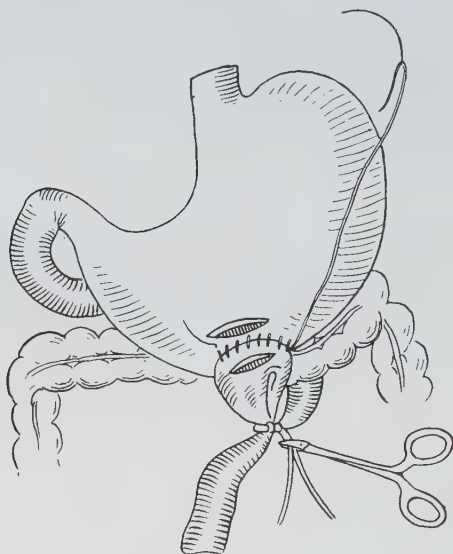


FIG. 60.—ANTERIOR GASTRO-ENTEROSTOMY.

1. By simple suture.
2. By Robson's bobbin.
3. By Murphy's button.

The suture employed in 1 and 2 is practically the same. The bobbin is used as a splint upon which the stitches may be tightly pulled. By its use an opening of a known size is immediately secured. Murphy's button is generally used only when the greatest haste is desirable. As the stitching in either of the two former methods can be done in from four to eight minutes by practised hands, the button is rarely,

if ever, necessary. Mikulicz regularly employs it, and speaks well of it, and many other surgeons prefer its use to all other methods. If, however, its one advantage, rapidity, is negated by the operator having accustomed himself to the details of simple suture, the button can only be harmful.

Method of Stitching.—The stomach and intestine being placed in apposition, a continuous Lembert stitch of silk, or

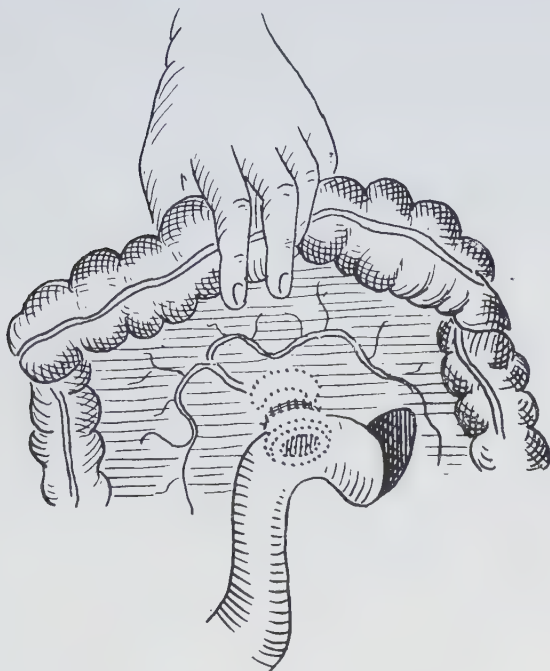


FIG. 61.—POSTERIOR GASTRO-ENTEROSTOMY WITH THE AID OF MAYO ROBSON'S BONE BOBBIN.

Pagenstecher thread, unites the serous surfaces for a distance of 2 inches or more. The line of this stitch is semi-oval, and unites the posterior surfaces of the anastomotic opening. Incisions are then made into the viscera in front of the suture. A second suture is now passed, uniting the posterior cut edges; this may take only the mucous membrane, or all the coats, and is of catgut. After completing the posterior half, the bobbins (if one is used) is introduced. The anterior

layers of stitches are now completed, first the cut edges and then the serous coats, in precisely the same fashion as the posterior. If the bobbin is used, the sutures are drawn tight on to it in tying. If not, the stitch must be interrupted at one point or more (one point is sufficient) in order to prevent the suture 'drawing' and puckering the orifice.

Murphy's Button. — The purse-string suture usually em-

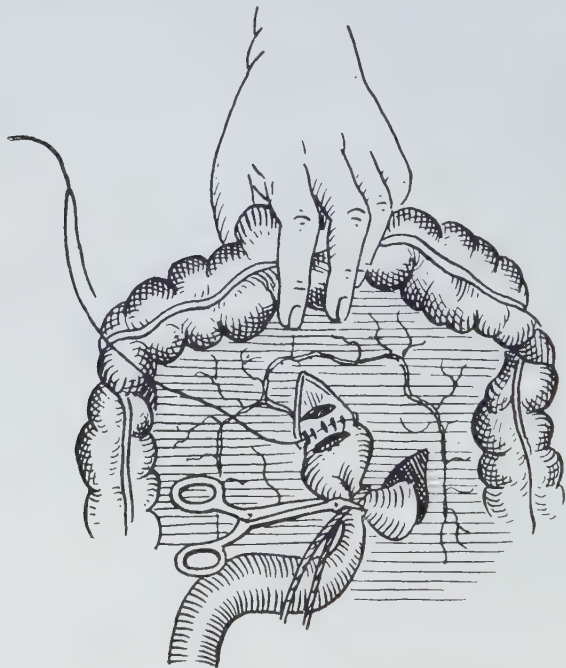


FIG. 62.—POSTERIOR GASTRO-ENTEROSTOMY. SIMPLE SUTURE.

ployed is unnecessarily cumbersome, and probably harmful, puckering up the coats of the gut around the central tube, and preventing accurate fitting of the opposed serous surfaces when the button is closed. The better method is to make a small incision into the viscus, introduce the half-button, and stitch up the incision by one or two Lembert sutures until the cylinder is tightly gripped. If the stitches are to the left of the button in the stomach, they may be

with advantage put to the right in the jejunum, in order to secure perfect accuracy of serous coaptation. Though Murphy's button enables a rapid and effective anastomosis to be made, the remote dangers are not inconsiderable. We hardly think it likely that we shall ever use it again in performing gastro-enterostomy.

Removal of Mucous Membrane.—Chlumskij, in reporting from the clinic of Mikulicz the results of ten post-mortem examinations performed upon cases of gastro-enterostomy in which the simple suture had been used, found that in all the opening was not of adequate size. This lessening in the size of the opening may be due either to cicatricial contraction or to thickening and pouting of the mucous membrane at the orifice. Kelling (*Archiv. f. Klin. Chir.*, Bd. 62) states that the chief advantage of the Murphy button over simple suture is the prevention of the formation of a ring of mucous membrane which projects into the stomach and occludes the new opening. To avoid this, it will be found helpful to remove a small portion of the mucous membrane of each viscus. This may be done in the following manner: When incising the gut, the serous and subserous layer are cut through carefully. The mucous membrane then bulges into the wound, is seized with nipped forceps, loosened on each side from the sub-mucous coat, and an ellipse of it as long as the wound and $\frac{3}{4}$ inch broad is cut away. This procedure has been followed by Moynihan during the last eighteen months, and has given eminently satisfactory results. A very simple and efficient method of performing gastro-enterostomy, and other intestinal anastomoses in which removal of the mucous membrane is an essential feature, is described by Littlewood (*Lancet*, November, 1900).

Gastro-duodenostomy.

This operation was first suggested in 1892 by Jaboulay, and performed by him in 1894. He has since related four cases, three of them successful. The operation has been warmly approved by Mikulicz and Villard. The anastomosis is made

between the pyloric end of the stomach and the anterior surface of the duodenum. Each viscus is opened by a vertical incision, and union may be effected either by the bobbin or by simple suture. The operation is most easily performed when there is a largely dilated stomach and a mobile duodenum. In one case reported by Spencer, any other gastro-intestinal anastomosis was impossible by reason of extensive adhesions which affected all but the pyloric portion of the stomach. When the pyloric region is adherent or invaded by growth the operation is impossible.

The advantages of this procedure over gastro-jejunostomy are claimed to be, the easier emptying of the stomach at an orifice near the natural outlet, and the absence of bile regurgitation owing to the fact that the new opening in the intestine is placed above the bile-papilla. We have adopted the method in one instance only, but we feel that it is one that may be more frequently adopted with advantage.

After Effects of Gastro-enterostomy.

1. **Regurgitant Vomiting** has been very much more frequently observed in malignant than in simple disease. The cause of it is difficult to determine. In some cases, as in those of Mikulicz, it is apparently due to spur-formation at the new orifice, of such a kind as to determine the flow of the intestinal contents into the stomach, rather than in the reverse direction. At times the vomiting is trivial, occurring but once or twice; at times, again, it is most serious, and hastens or determines death. It may be dealt with most satisfactorily by occasional or frequent lavage (as seems necessary) and by abstinence from mouth-feeding. The vomit in the beginning is in appearance chiefly composed of bile, and it was to the presence of bile in the stomach that the vomiting was attributed. Riegel, Malbranc and Weil have related cases where a reflux of bile into the stomach resulted in grave symptoms. Billroth remarked upon the serious import of bile regurgitation after gastro-enterostomy. Claude Bernard and others, founding their opinion upon laboratory

work, considered that bile inhibited gastric digestion. Dastre, in dogs with gastric fistulæ, introduced bile at all stages of digestion, and concluded that the alkalinizing effect of the bile was swiftly negated by a copious outflow of gastric juice. No ill-effects were noticed either in the digestive powers or in the general health. Oddi, experimenting upon dogs, obliterated the common bile-duct and united the gall-bladder to the stomach. All the bile consequently flowed at once into the stomach, with the result that the animals gained in weight and suffered not at all. Max Wickhoff, Angelberger and Terrier have performed cholecysto-gastrostomy for obstruction in the common bile-duct. These observations all show that the mere presence of bile alone is insufficient to induce vomiting. Chlumskij has suggested that it is the presence of pancreatic juice which so irritates the stomach as to make it reject all fluids. But this theory is negated by Steudel's experiments upon dogs and by Moynihan's case, in which, owing to a complete severance of the gut at the duodeno-jejunal junction, the duodenum was stitched up completely, and the open end of the jejunum implanted in the anterior wall of the stomach (*British Medical Journal*, May, 1901). In this case all the bile and all the pancreatic juice passed into the stomach, yet digestion was active and complete, and vomiting was absent. Moreover, Hartmann and Soupault have recently shown that in all cases of gastro-enterostomy, whether anterior or posterior, there is a reflux of bile and of pancreatic juice into the stomach. Carle and Fantino, Hayem, Mathieu and others, have made the same observation. The cause, then, of regurgitant vomiting is not understood. Numerous 'complementary operations' have been suggested in order to prevent it. Doyen cuts the intestine across, implants the distal end into the stomach and the proximal into the side of the distal, and thus avoids the 'circulus vitiosus.' Jaboulay, Braun and Weir advise a side-to-side approximation of the proximal and distal loops.

2. **Subsequent Contraction of the New Orifice** between the stomach and intestine must occur to some extent in all cases when the dilatation of the stomach, present at the operation,

undergoes progressive diminution. Moynihan has recorded one case in which he performed a second operation for closure of the orifice, made with the help of Laplace's forceps, and has operated upon another in which a colleague had, three years previously, performed gastro-jejunostomy with the aid of Murphy's button. In this latter case the opening had completely closed. Czerny records a case where the Murphy button was used, in which the opening narrowed from a diameter of 5 centimetres to 8 millimetres. In all cases the anastomosis should be of wider calibre than seems necessary, in order to avoid the risk of subsequent over-contraction.

As bearing on the closure of an anastomotic opening, Mayo Robson found the opening in a cholecyst-enterostomy made by a Murphy button to be closed three months later, as proved post-mortem, in a case of complete obstruction of the common bile-duct.

W. H. Brown relates the following case of closure of an anastomotic opening made by Senn's plates (*Lancet*, July, 1900):

The patient, a woman, aged sixty-two years, had suffered for many months from pain after food, the pain gradually becoming most acute, so that opium in full doses was needed to obtain anything like comfort.

Latterly, regular attacks of vomiting occurred about every forty-eight hours, when most of the nourishment taken during the preceding two days returned.

No tumour could be felt, but the symptoms all pointed towards pyloric stenosis. As the condition of the patient was getting unendurable, I decided, after consultation with Dr. T. Churton, to open the abdomen to see if anything could be done. At the operation I found the pylorus greatly thickened, and masses of enlarged glands constituting too great an area of disease to be attacked with any degree of safety. I therefore joined up a loop of jejunum to the stomach, using Senn's plates as the scaffold of anastomosis.

For the next two weeks all went as well as such cases usually do, the vomiting ceased, and the pain gradually subsided. At the end of that time, however, the symptoms of obstruction began to reassert themselves, the pain again grew severe, and again the

regular vomiting began, the amount corresponding with the quantity of fluids taken.

It seemed clear that the new opening had, for some reason or other, ceased to be effectual.

I therefore was face to face with a most discouraging chain of events, and the patient herself was as badly off as she was before she submitted herself to operative interference.

I decided to act on the assumption that the new opening between the stomach and the jejunum had closed, and determined to reopen for the purpose of ascertaining the reason. Accordingly I reopened the abdomen, and I found that the junction between the bowel and the stomach externally was quite satisfactory.

I then made an incision into the stomach 2 inches above the junction, and, putting my finger inside, found that all trace of the bone-plate had disappeared, and also that all trace of the opening was absent.

After a minute or two I felt the edge of the oval cut of the former operation, and, pressing firmly in the centre of this, tore through a membrane by which the opening had been occluded.

My finger then passed easily into the bowel, and I stretched the opening freely in all directions. I then closed the exploratory incision into the stomach, and finished the operation in the usual manner. After a day or two, during which time vomiting was incessant, improvement set in.

The pain again left, and it has not since returned. The patient is able to take light food, and the vomiting has ceased.

She is now out of bed daily, and is gaining strength. [This patient is still alive (April, 1901) and well.]

3. Changes in the Stomach.—If dilatation, as the result of obstruction, has been present before the gastro-enterostomy, a certain lessening in the size of the stomach may be expected to occur as soon as a fresh outlet is formed. The extent of this lessening depends entirely upon the condition of the muscular tunic of the stomach. If the stomach has dilated gradually, during many months or years, and if the dilatation has been extreme, there will be little or no rebound, the dilatation will undergo little or no perceptible diminution. On the other hand, if dilatation has been rapid in its oncoming and has never attained a supreme degree, the return to the normal size of the stomach will be almost, or

wholly, complete. In cancer of the stomach, or in trauma resulting from swallowing acids, etc. (Terrier and Hartmann), where the latter conditions are fulfilled, the stomach rapidly reduces in size after operation; in simple stenosis, where the former conditions are found, the return is always trivial, if, indeed, there be any return at all. The **motor insufficiency** of the stomach is, according to Hartmann and Soupault, a permanent matter. A return to the normal was never observed in any of their cases, even when the examination was made after one year. Gastric digestion is prolonged beyond the normal limits. Mintz and Rosenheim have shown that there is a marked delay in the evacuation of the stomach contents. Carle and Fantino, on the other hand, assert that the emptying of the stomach after a full meal is not only accomplished within the period of physiological limit, but is actually accelerated. They add: 'This is often observed immediately after the operation, and almost, or almost always, in the months that follow.'

Ulcus Pepticum.—Cases of peptic ulcer in the jejunum after gastro-enterostomy are recorded by Braun, Halm, Kausch, Körte, Steinthal, Hadra, and Neumann. In four cases the ulcer perforated and proved fatal. All the operations were performed when hyperchlorhydria was marked and persistent. Under such condition, Neumann suggests that the operation of jejunostomy should be performed. The opening made in the bowel can be closed as soon as the gastric juice has returned to its normal condition (*Deut. Zeit. f. Chir.*, 1901).

Results of Gastro-enterostomy.

Chlumskij (*Beit. z. Klin. Chir.*, 1898) has collected 550 cases of gastro-enterostomy, which show the following results:

Between the years 1881 and 1885, 35 cases—12 recoveries, 23 deaths = 65·71 per cent.

Between the years 1886 and 1890, 114 cases—61 recoveries, 53 deaths = 47 per cent.

Between the years 1891 and 1896, 401 cases—265 recoveries, 136 deaths = 33·91 per cent.

The mortality for all classes of case is seen to be a gradually diminishing one. There is, however, an obvious and a striking difference between cases of cancer and cases of simple stenosis or ulceration. Haberkant calculates a mortality of 43·5 per cent. in malignant, and of 25·5 per cent. in simple cases; Chlums kij 41·6 per cent. for malignant, and 21·4 per cent. for simple cases; Goffe (quoted by Barker) for English and American cases, 41·5 per cent. and 36·3 per cent. respectively.

In the Hunterian Lectures, Mayo Robson tabulated 1,978 cases with 720 deaths, a mortality of 36·4 per cent.

The following is a complete list of all our gastro-enterostomies. We have divided them into simple and malignant cases, and the simple, again, into those done by the anterior and those by the posterior method :

POSTERIOR GASTRO-ENTEROSTOMY FOR SIMPLE DISEASES OF THE STOMACH.

CASE 1.—Mr. J. S., of Batley, aged forty-five. Seen at infirmary. Two years' pain. Nine months' vomiting. Great dilatation. Thickening and puckering near pylorus. Exploratory gastrotomy. Large ulcer on posterior wall. Operation June 12, 1900 (posterior gastro-enterostomy). Complete recovery. Well 1901.

CASE 2.—Mrs. H., aged twenty-three. Seen with Dr. Humphery of Armley. Acute hæmatemesis. Numerous ulcers. Operation July 6, 1900 (post-gastro-enterostomy after gastrotomy). Quite well 1901. Full report under Hæmatemesis.

CASE 3.—Miss H., aged thirty-two. Seen with Dr. Angus of Bingley. Ten years' history of gastric ulcer. Hæmatemesis 1892 and 1896. Great dilatation. Pyloric ulcer and stenosis. Operation October 5, 1900 (posterior gastro-enterostomy). At operation 6 stones 12 pounds. Now 8 stones 6 pounds.

CASE 4.—Mr. H., aged fifty-five. Seen with Dr. Hearder of Ilkley. Symptoms of ulcer three years. Modified hour-glass stomach. Great loss of flesh. Dilatation of stomach. Anæmic, and, though 6 feet, only weighed 8 stones 6 pounds. Operation October 12, 1900. Recovery. At operation 8 stones 6 pounds. Now 9 stones 11 pounds and quite well.

CASE 5.—Mr. H., aged thirty-five. Seen with Dr. Mercer of Bradford. Pancreatic abscess due to ulcer of stomach. See full

notes under Perforation. Operation October 18, 1900. Recovery. Quite well April, 1901.

CASE 6.—Miss R. B., of Bradford, aged thirty-one. Seen at infirmary. Six years' pain and vomiting. Hæmatemesis. Last attack three weeks before. Great loss of flesh. Weight 6 stones 11 pounds. Operation June 18, 1900. October 19, weighs 7 stones. Quite well.

CASE 7.—Mrs. A. P., of Cleckheaton, aged thirty-eight. Seen at infirmary. Five years' history. Tenderness at epigastrium. Pain after food and vomiting. Loss of weight extreme. Operation November 1, 1900. Good recovery.

CASE 8.—Miss D. B., of Grantham, aged twenty-five. Seen at infirmary. Extensive ulceration and contraction of stomach. Hour-glass distortion. Active ulceration at constriction. Operation November 15, 1900. Recovery. Convalescence tardy, and had to keep on milk for some time. April, 1901, has gained 7 pounds.

CASE 9.—Mrs. G. W., of Birstall, aged fifty. Seen at infirmary. Thirty-six years' history. Hæmatemesis. No solid food for eight months. Free HCl. 8 stones 1½ pounds. No tumour. Very strong adhesions to anterior abdominal wall. Old perforation. Operation November 29, 1900. Good recovery. Restoration to health.

CASE 10.—Mrs. R. Seen with Dr. West, Morley. Extreme dilatation of posterior wall after gastroplication of anterior. Perigastritis (see notes at length elsewhere). Severe pain after food. Operation December 5, 1900. Recovery. Well April, 1901.

CASE 11.—Mr. J. H., of Culgaith, aged fifty-three. Seen at infirmary. Two years' history. Pain after food. Lost 3 stones. Free HCl. Hour-glass contraction 3 inches from pylorus. Operation December 6, 1900. Recovery. Convalescence retarded by vomiting fortnight after operation, necessitating milk diet for a time. Solids taken freely later. Complete recovery.

CASE 12.—Mr. W. H. M., of Cleckheaton, aged fifty-four. Seen at infirmary. Six years' history of ulcer and vomiting at intervals. Lost 2 stones in weight. Tenderness at epigastrium. Dilatation. Free HCl. Stomach puckered and thickened. Strong adhesions. Weight 8 stones 11 pounds. Operation December 20, 1900. Recovery. Out-patient January 14.

CASE 13.—Mr. H. H., of Northallerton, aged forty. Seen at infirmary. Twenty-two years' history. Two years' symptoms, severe. Slight hæmatemesis. Tenderness. Dilatation. 9 stones 10 pounds. Adhesions. Scars of ulcers on anterior surface. Operation January 3, 1901. Good recovery.

CASE 14.—Mrs. L., aged thirty-eight. Seen with Dr. Mackenzie of Burnley. Indigestion twenty years. Pain constant; lately $1\frac{1}{2}$ hours after food. Pain easier on lying down and on face. Lost 1 stone 11 pounds. Scars of ulcers on pylorus and anterior wall. Stenosis of pylorus. Glands in lesser omentum. Operation January 8, 1901. Recovery. 6 stones 11 pounds at operation; 7 stones 9 pounds two months later.

CASE 15.—Mrs. I., aged thirty-six. Symptoms of gastric ulcer five years. Once perforation suspected. Severe hæmatemesis at first. Adhesions to anterior abdominal wall, etc. Operation January 21, 1901. Recovery. Well April.

CASE 16.—Miss D., aged forty-nine. Seen with Dr. Hindle. (See full report under Hour-glass Stomach, p. 173.) Operation January 24, 1901. Recovery. 8 stones 5 pounds at operation; 8 stones 9 pounds a month later.

CASE 17.—Mrs. E. W., of Barnsley, aged thirty-six. Seen at infirmary. Two years' pain after food. Vomiting at times. Melæna. 9 stones 8 pounds to 7 stones 4 pounds. Dilated stomach to 1 inch below umbilicus. Free HCl present. Operation January 31, 1901. Good recovery. Well April, 1901.

CASE 18.—Mrs. M. B., aged fifty-six. Seen at infirmary. Three years ago gastro-enterostomy done for peripyloritis from gall-stones (Murphy). Return of symptoms. Dilated stomach. Operation February 5, 1901. Recovery. Much relieved.

CASE 19.—Miss S. H., of Harrogate, aged twenty-one. Seen at infirmary. Six years' digestive troubles with vomiting. Contracted and scarred stomach. Tenderness at epigastrium. Free HCl. Weight 6 stones 2 pounds. Stomach extensively ulcerated and thickened and puckered. Operation February 8, 1901. Recovery. February 21 had got to take solids; then vomited blood and had great pain. Rectal feeding, then milk, etc., given. Well April and taking ordinary food.

CASE 20.—Mrs. M. A. G., aged forty-four. Seen at infirmary. Chronic ulcer fourteen months. Large incompetent stomach. Ulcer on posterior wall, near pylorus. Operation February 11, 1901. Recovery. Quite well April 3, 1901.

CASE 21.—Mrs. M. H., aged twenty-two. Seen at infirmary. Intractable ulcer for nearly one year, unrelieved by treatment. Hyperchlorhydria. Reichmann's disease. Operation February 12, 1901. Recovery.

CASE 22.—Mr. S., aged sixty-four. Seen with Dr. Thorburn of Sedbergh. Two years' history of pain and vomiting—lately coffee-ground vomit in large quantity. No tumour felt. At operation thickening along lesser curvature and at pylorus. Glands. Very feeble indeed. Operation February 14, 1901.

Uninterrupted recovery. April 4, 1901, letter to say he has gained 2 stones since operation.

CASE 23.—Mrs. S. B., aged thirty-one. Seen at infirmary. Symptoms of chronic gastric ulcer for some years. For five to six months pain and vomiting severe and disabling. Dilated stomach. Three ulcers seen. Operation February 16, 1901. Recovery. Complete relief.

CASE 24.—Mrs. L. S., aged thirty-one. Seen at infirmary. Perigastritis, the result of gall-stones. Large stomach, with characteristic signs and symptoms of dilatation. Operation February 19, 1901. Recovery. Entirely relieved.

CASE 25.—Mrs. E. W., aged twenty-seven. Seen at infirmary. Gastric ulcer. Under treatment for nearly two years without relief. Hyperchlorhydria. Reichmann's disease. Operation February 19, 1901. Recovery.

CASE 26.—Mr. W. B., aged sixty. Seen at infirmary. Ulcerated stomach twenty years ago. Under constant treatment for two years with pain and frequent vomiting. Dilated stomach. Ulcer 1 inch from pylorus. Operation February 22, 1901. Recovery.

CASE 27.—Mr. H. Seen with Dr. Irving of Huddersfield. Dilatation of stomach. Probably congenital stenosis. Operation February 25, 1901. Recovery.

CASE 28.—Miss N. G., of Sheffield, aged twenty-seven. Seen at infirmary. Pain and indigestion since she was a girl; vomiting at times. Stomach dilated and tender. Loss of weight. Free HCl. Weight 7 stones 6 pounds. Operation March 7, 1901. Recovery. Soft solids allowed at month end; ultimately good recovery, and can take food without pain.

CASE 29.—Miss B., aged thirty. Seen with Dr. Empey of Cross Hills. Ten years' symptoms. Dilatation halfway to pubes. Weight 5 stones 3 pounds; once 7 stones. Vomiting, pain and tetany. Operation March 8, 1901. Recovery. Returned home at end of month. Looks much better and says feels well.

CASE 30.—Lady, aged fifty-two. Seen with Dr. Findlater. Stomach symptoms for many years. Fourteen years and eight years ago severe hæmatemesis. Liquid food in small amounts can only be taken. Very thin and feeble. Stomach small and thickened. Numerous scars seen on stomach. Operation March 20, 1901. Recovery. Letter on April 10 to say lost pain and taking food well.

CASE 31.—Mr. F., aged sixty-three. Seen with Dr. White, Essex. (See full report under Hæmatemesis). Operation

March 22, 1901. Recovery. Left fourth week. Can eat anything and feels well. Gained 4 pounds in fourth week.

CASE 32.—Miss G., aged twenty-seven. Seen with Dr. Dolan, Halifax. Symptoms of ulcer six years. Loss of weight. Anæmic. Pain $1\frac{1}{2}$ hours after food. Tenderness. At operation scars of ulcers found. Operation March 22, 1901. Recovery. Returned home well April 17, 1901.

CASE 33.—Mr. A. P., aged thirty-two. Seen at infirmary. Duodenal ulcer. Melæna. Vomiting for five years. Large duodenal ulcer and scar of gastric ulcer. Operation March 24, 1901. Recovery.

CASE 34.—Mr. F. H., aged twenty-two. Seen at infirmary. Five months' pain and vomiting after food. Hæmatemesis. Loss of 18 pounds in weight. Very slight jaundice. Stomach reaches to umbilicus. Free HCl in stomach contents. Adhesions and cicatrix found. Operation March 28, 1901. Uninterrupted recovery. Fish on fourteenth day.

CASE 35.—Mr. A. M., aged twenty-three. Seen at infirmary. Three years' vomiting at intervals. Wasting 17 pounds. Tetany. Has washed stomach out ten months. Stomach dilated to umbilicus. Weight 7 stones 4 pounds. Free HCl in stomach. Scarring near pylorus. Operation March 28, 1901 (post-gastro-enterostomy). Bone bobbin. Recovery.

CASE 36.—Miss A. R., aged thirty-nine. Seen at infirmary. Indigestion eight years. Pain after food. Nine months ago pain in left loin; three months' pain 2 inches above umbilicus. Flatulence. Steady loss of weight. Loss of 8 pounds during last year. Stomach dilated nearly to pubes. Upper border lower than normal. Movable kidneys, especially the left. Weight 7 stones 3 pounds. Free HCl reduced in amount. Shortening of lesser omentum. Scar on posterior wall of stomach. Operation March 28, 1901 (post-gastro-enterostomy). Bone bobbin. Died twelfth day. Septic wound, leading to peritonitis. No leakage between stomach and bowel. Kidneys granular.

CASE 37.—Mr. C. R. R., aged twenty-six. Seen at infirmary. Four years' indigestion. Two months' severe pain in epigastrium after food. Retching and nausea. Great loss of weight and strength. Stomach when distended reached 2 inches below umbilicus. Free HCl found. Patient extremely feeble and thin. Had been under medical supervision for many months. For three months had lived on liquids because of pain after food. Weight 6 stones 1 pound. Operation March 28, 1901. Died eleventh day. Phthisis, right apex. Pneumonia, right base (? due to ether). Wound healed. No peritoneal condition. Union between stomach and bowel satisfactory.

CASE 38.—Miss N. Seen with Dr. Barrs. Symptoms of ulcer for several years. Great loss of flesh and debility. Three ulcers seen on anterior surface of stomach and one on posterior. Great dilatation. Operation April 3, 1901. Good recovery.

CASE 39.—Mrs. J. W. T., aged forty-two. Seen at infirmary. Four years' pain and vomiting after food. Loss of 22 pounds in weight. Unable to work or gain a living. Stomach, when undistended, reaches to within 1 inch of umbilicus. When distended with CO₂, much below umbilicus. Vomiting frequent. Pain after food. Operation April 4, 1901 (post-gastro-enterostomy). Bone bobbin. Recovery. Has not vomited since operation. Wound healed by first intention.

CASE 40.—Miss A. R., aged thirty-six. Seen at infirmary. Ten years' indigestion. Had hæmatemesis four years ago. Two years' severe pain after food. Loss of 6 pounds in last six months. Unable to take solid food because of pain. Invalid for nine months. Dilated stomach reaching below umbilicus. Tenderness at epigastrium. Operation April 4, 1901 (post-gastro-enterostomy). Bone bobbin. Recovery.

Total: forty cases. Two deaths.

ANTERIOR GASTRO-ENTEROSTOMY FOR SIMPLE DISEASE OF THE STOMACH.

CASE 1.—Mr. J. S., aged fifty-four. Seen at infirmary. Contraction of scar after pylorotomy. Operation September 10, 1891. Senn's plates. Death fourth day from exhaustion. Post-mortem. No peritonitis and union good.

CASE 2.—Mrs. M. S., aged forty-eight. Seen at the infirmary. Two years' history of pain after food, etc. Six months tumour. Operation December 21, 1893. Bone bobbin. Good recovery.

CASE 3.—Mr. R. C., aged forty-five. Seen at infirmary. Two years' pain and vomiting. Stricture of pylorus. Loss of weight 2 stones in four months. Weight 8 stones 1½ pounds. Operation September 12, 1895. Bone bobbin. Recovery. Well in 1897.

CASE 4.—Mrs. M. B., aged thirty-three. Seen at infirmary. Ten years' history. Dilatation. Visible peristalsis. Pain, vomiting; vomit acid. 7 stones 2½ pounds. Operation February 4, 1897. Bone bobbin. Recovery. March, 7 stones 12½ pounds.

CASE 5.—Mr. G. I., aged twenty-three. Seen at infirmary. Six years' pain and vomiting; four years ago hæmatemesis. Has lost 16 pounds in twelve months. Operation October 21,

1897. Bone bobbin and omental graft. Recovery. Out-patient March 20.

CASE 6.—Dr. B., aged thirty-one. Seen with Dr. Barrs. Seventeen years' pain and dyspepsia; vomiting sixteen months. Stomach reaches pubes. Visible peristalsis. Extensive tumour and discrete glands. Weight 8 stones 6 pounds. Operation May 6, 1898. Bone bobbin. Recovery. August 17, 1898, weighs 9 stones 3 pounds. Well and in active work 1901.

CASE 7.—Mrs. W. Seen with Dr. Salter of Scarborough. Pyloric stenosis and dilatation of the stomach. Operation September 4, 1898. Bone bobbin. Recovery. Had regained lost weight and health 1900.

CASE 8.—Mr. A., aged twenty-eight. Seen with Dr. Kilner Clarke of Huddersfield. Chronic ulcer. Pyloric tumour. Great dilatation of stomach. Pain two hours after food; vomiting of coffee-ground material. Two years' history, and loss of weight of 3 stones 6 pounds. Operation August 4, 1899. Bone bobbin. Recovery. September 20, weight 10 stones 13 pounds. Well 1901.

CASE 9.—Mr. R. K., aged thirty-seven. Seen at infirmary. Several years' pain after food, etc.; three months' severe pain and vomiting. In three months lost 21 pounds. Stomach 2 inches below umbilicus. Free HCl. Operation September 28, 1899. Bone bobbin. Adhesions around pylorus thickened and stenosed. Death fourth day.

CASE 10.—Mr. C. W. C., aged thirty-four. Seen at infirmary. Tumour of pylorus. Stomach 3 inches below umbilicus. One stone lost in twelve months. Weight 7 stones 8 pounds. Operation November 9, 1899. Murphy button. Recovery. Out-patient. Weight 8 stones 8 pounds.

CASE 11.—Mr. T. S., aged twenty-two. Seen with Dr. Churton at infirmary. Severe hæmatemesis; lost $2\frac{1}{2}$ stones. Operation for hæmatemesis from duodenal ulcer. Operation December 1, 1899. Murphy button. Death. Leakage on ninth day when button separating. Post-mortem: Perforated vessel found in duodenum, securely blocked by organizing clot. (See Hæmatemesis.)

CASE 12.—Mr. C., aged thirty-eight. Seen with Dr. Peter MacGregor of Huddersfield. Pyloric ulcer and hæmatemesis. Operation January 4, 1900. Recovery. Well April, 1901. (See Hæmatemesis.)

CASE 13.—Mrs. E. B., aged forty-one. Seen at infirmary. Gastric ulcer when sixteen; since then chronic dyspepsia, gradually getting worse. Four months' continuous medical treatment

produced no improvement. Operation January, 1900. Laplace's forceps. Recovery. Complete restoration to health.

CASE 14.—Mr. A. B., aged fifty-five. Seen at infirmary. Dyspepsia for ten or twelve years, culminating five years ago in an 'attack' of pain and continuous vomiting, lasting two weeks. Stomach descends behind pubes. Operation January, 1900. Laplace's forceps. Recovery. Return of symptoms; see later.

CASE 15.—Mr. F. S., aged thirty-five. Seen at infirmary. Gastric ulcer two years ago, now hyperchlorhydria and dilatation of stomach. At first great improvement under medical treatment, but progressive loss of health for many months now. Reichmann's disease. Operation February, 1900. Laplace's forceps. Recovery. Quite well up to date.

CASE 16.—Mr. A. B., aged fifty-five. Seen at infirmary. Return of symptoms. At second operation the anastomosis found closed entirely. Operation March, 1900. Murphy button. Recovery. Complete relief April, 1901.

CASE 17.—Miss I., aged thirty-two. Seen with Dr. Mackenzie of Bradford. Fifteen years' symptoms of ulcer. For six years lived on liquid food; lately bedridden. Feeble and emaciated. Stomach extensively ulcerated and scarred. Extra scarring 2 inches from pylorus. Operation April 27, 1900. Death twelfth day from perforation of ulcer, which occurred at 12.30 a.m., and she died at 4.30 from shock. Very well on morning of accident.

CASE 18.—Mr. F. H., aged thirty-two. Seen at infirmary. Symptoms for ten months. Very dilated stomach; vomits every three or four days. Operation June, 1900. Suture. Recovery. Can eat anything, and has regained lost weight.

CASE 19.—Mrs. S. H., aged forty-nine. Seen at infirmary. Symptoms nine months; more severe for five months. Pain for two hours after food, and continuing until vomiting is induced. No solid food for two and a half months. Dilated stomach. Operation August, 1900. Suture. Recovery. Complete relief April, 1901.

Total: nineteen cases. Fifteen recoveries. Four deaths.

GASTRO-ENTEROSTOMY FOR CANCER.

CASE 1.—Miss E. G., aged twenty-one. Seen at infirmary. Three months' symptoms. Pyloric tumour. Dilatation. Operation May 1, 1890 (anterior). Senn's plates. Recovery. Lived three or four months.

CASE 2.—Mr. J. S., aged fifty-three. Seen at infirmary. Five months' symptoms. Tumour of pylorus. Operation September 8, 1891 (anterior). Senn's plates. Death October 24.

CASE 3.—Mr. J. W., aged thirty-eight. Seen at infirmary.

Twelve months' symptoms; five months' tumour. Fixed tumour and nodules in skin. Dilatation of stomach. Operation June 8, 1892 (anterior). Bone bobbin. Death June 23. Exhaustion and vomiting. Autopsy. Union of new opening good.

CASE 4.—Mr. J. P., aged forty-three. Seen at infirmary. Seven months' symptoms. Tumour. Dilatation. Large growth of pylorus and lesser curvature. Lost 2 stones. Operation March 10, 1894 (anterior). Bone bobbin. Death March 21 from exhaustion.

CASE 5.—Mr. S. S., aged forty-four. Seen at infirmary. Three months' symptoms. Tumour. Loss of 3 stones 8 pounds in that time. Operation November 20, 1895 (gastro-duodenostomy). Bone bobbin. Death November 21.

CASE 6.—Mrs. B., aged sixty-five. Seen with Dr. Dobson. Cancer of pylorus. Tumour four months. Extremely feeble; constant vomiting. Dilatation of stomach. Operation November 25, 1895 (anterior). Death from shock.

CASE 7.—Mr. C., aged fifty-nine. Seen with Dr. Lockie of Carlisle and Dr. Gordon Black of Harrogate. Cancer of pylorus and stomach, rather extensive. Operation July 6, 1896 (anterior). Recovery. Lived four months in comfort.

CASE 8.—Mr. G., aged fifty-two. Seen with Dr. Woodcock of Beeston. Thirteen years' history of ulcer; tumour recent. Cancer of pylorus and dilatation. Operation August 5, 1896 (anterior). Died. Extravasation sixth day.

CASE 9.—Mr. C. M., aged forty-nine. Seen at infirmary. Dilated stomach. Vomiting. Loss of weight. Cancer of pylorus. Operation November 19, 1896 (anterior). Recovered.

CASE 10.—Mrs. M. W., aged thirty-two. Seen at infirmary. Symptoms five months. Vomiting, pain, dilated stomach, and pyloric tumour. Growth; secondary deposits in liver. Continuous uncontrollable vomiting for three weeks. Operation July 3, 1896 (anterior). Murphy button. Recovered. Lived fifteen weeks.

CASE 11.—Mr. J. C., aged forty-six. Seen at infirmary. Swelling at pylorus, dilated stomach, great wasting. Large malignant nodule in liver. Operation May 14, 1898 (anterior). Murphy button. Recovered. Died December 30, 1898.

CASE 12.—Mr. F. W., aged fifty-one. Seen at infirmary. Malignant tumour at pylorus; vomiting, emaciation. Operation May 20, 1898. Murphy button. Recovery. Lost sight of.

CASE 13.—Mr. A. C., aged forty. Seen at infirmary. Four years' symptoms of ulcer, indigestion, and vomiting. Lost 2 stones. Tumour. Operation May 26, 1898. Murphy button. Recovery. Returned to work. Died August 29, 1899.

CASE 14.—Mrs. E. W., aged twenty-nine. Seen at infirmary. Large tumour at pylorus; great emaciation. Vomiting incessant. Operation July 6, 1898 (posterior). Murphy button. Recovery. Lived fifteen weeks without any vomiting; very greatly relieved.

CASE 15.—Mrs. A. K., aged forty. Seen at infirmary. Tumour equal to walnut at pylorus; vomiting, wasting, etc. Secondary nodules and extensive glands. Operation February 20, 1899 (posterior). Murphy button. Died eighth day. Deposit in lungs. Acute œdema of lungs.

CASE 16.—Mr. M. C., aged forty-seven. Seen at infirmary. Gastric trouble for two or three years. Vomiting and pain. Lost 14 pounds in last eleven weeks. No tumour felt. At operation extensive malignant disease. Operation August 2, 1899 (anterior). Murphy button. Died fifth day. Shock.

CASE 17.—Mrs. S., aged thirty-seven. Seen with Dr. Dimmock of Harrogate. Cancer of body of stomach and pylorus. Dilatation of stomach. Operation December 21, 1899. Recovery. Good recovery, and was so well that gastrectomy was advised; but cancer of uterus supervened and prevented further operation. Lived nine months.

CASE 18.—Mr. J. S., aged forty-three. Seen at infirmary. Three and a half years' history of pain and vomiting; lost 2 stones in weight in two years. Operation January 19, 1900 (anterior). Bobbin. Died next day, congestion of lungs. Autopsy: Pylorus adherent to mass of growth in head of pancreas; calculi in gall-bladder.

CASE 19.—Mrs. J. H., aged fifty-two. Seen at infirmary. Loss of weight, vomiting, dilated stomach. Malignant disease of pylorus. Operation June 6, 1900 (anterior). Suture. Recovery. Still living.

CASE 20.—Mrs. S. T., aged thirty-six. Seen at infirmary. Nine months' constant vomiting; extremely feeble. Annular cancer 3 inches from pylorus (hour-glass). Operation September 23, 1900 (anterior). Bone bobbin. Died from exhaustion on fifteenth day. Life prolonged by operation and greater comfort.

CASE 21.—Mr. H. B., aged sixty-three. Seen at infirmary. Twelve months' tumour. See full notes under Gastrectomy. Operation November 15, 1900 (posterior). Recovery. Subsequent gastrectomy.

CASE 22.—Mrs. M. S., aged fifty-four. Seen at infirmary. Twelve months' history. Much vomiting. Tumour in epigastrium. Cancer along lesser curvature. Too weak for gastrectomy. Operation January 17, 1901 (posterior). Recovery. Made an out-patient; much relieved.

CASE 23.—Mrs. A. C., aged fifty-two. Seen at infirmary.

Stomach trouble for several years. Emaciation, vomiting, etc. Malignant disease at pylorus; adhesions to pancreas. Posterior. Suture. Recovery. Still living.

Total: twenty-three. Recovered thirteen. Died ten.

Pylorectomy, or Partial Gastrectomy.

Merrem in 1810 showed by experiment upon a dog the possibility of successful removal of the pylorus. In 1876 Gussenbauer and Winiwarter, and later Czerny and Kaiser, performed many successful operations upon dogs, and suggested the feasibility of the procedure in the human. On April 9, 1879, Péan performed the first pylorectomy in man; in 1880 Rydygier operated—both unsuccessfully. On February 28, 1881, Billroth performed the first operation, followed by recovery.

The abdomen is opened in the manner previously described. The area to be operated upon is surrounded with compresses or sponges. The vessel in the small omentum is ligatured in two places and divided. The fingers are then passed from above behind the pylorus, and made to define the vessels of the great omentum, which are similarly ligatured. Any adhesions are gently separated. Those between the pylorus and the pancreas are the most serious and the most difficult to deal with. The majority of surgeons consider that dense adhesions here forbid any attempt at extirpation, but it is interesting to note that in two cases recorded by Obalinski and M. Richardson, in which the adhesions were so tough as to prevent their stripping, a portion of the head of the pancreas was successfully removed. A similar removal in a case of cancer is recorded by Christy Wilson. If the pancreas be denuded, it should be covered by peritoneum borrowed from the lesser sac. Lymphatic glands are now sought for and removed. As shown by Mikulicz, Kader and Cunéo, the most numerous and the most important lie along the lesser curvature. All these, as they lie along the coronary artery, must be removed. In excising glands from the great omentum there is great danger of wounding the middle colic artery, and thereby causing gangrene of the transverse colon. The glands along the greater curvature are most numerous

near the pylorus. The stomach and duodenum are then clamped and divided. (The most serviceable clamps are Doyen's hysterectomy clamps shielded with india-rubber tubing, or Kocher's clamps, specially devised for this purpose.)

Examination of a large number of specimens shows clearly that malignant disease of the stomach rarely infiltrates far into the duodenum, but does extend readily and rapidly towards the cardiac end of the stomach. In dividing the duodenum, then, it will suffice to remove 2 centimetres of apparently healthy tissue beyond the growth. In cutting across the stomach the incisions should be $1\frac{1}{2}$ to 2 inches

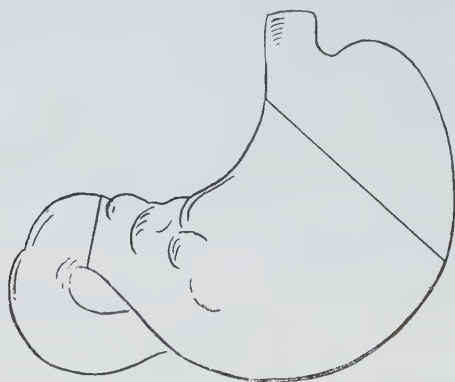


FIG. 63.—PARTIAL GASTRECTOMY.

wide of the disease at least. Pathological observations show that implication of the stomach along the lesser curvature and of the glands there is early and rapid, and the record of cases operated upon in which the disease recurs clearly proves the marked frequency of local return, rather than metastasis, as the cause of death. It is therefore probable that permanently successful operations will depend upon a very wide local removal, especially of the upper border of the stomach. We are strongly inclined to believe that, even in the earliest examples of pyloric growth, a removal of at least half, possibly more, of the stomach is necessary.

Union of the stomach and duodenum may be carried out in one of three ways :

1. Immediate suture of the cut ends (Billroth's first method).

2. Suture of the stomach opening; implantation of the duodenal cut end to the posterior surface of the stomach (Kocher).

3. Closure of both openings, and performance of a gastro-jejunosomy (Billroth's 'second method').

1. **Immediate union of cut ends**, advocated by Mikulicz and Krönlein, is best carried out by means of Robson's bone bobbin. The inequality in the size of the two openings is overcome by partial suture of the stomach incision, or by the making of a horizontal slit in the duodenal end. It is of the first importance that the new opening should be large, as several cases are recorded in which subsequent contraction of the orifice demanded a further operation. The method of suture is similar to that already described in gastro-enterostomy. The bobbin is of the greatest possible advantage here. A very large proportion of deaths in cases of simple suture have been due to leakage at what has been termed 'the fatal suture angle of Billroth.' This danger is wholly avoided by the use of the bobbin.

If simple suture is the method chosen, it may be carried out by the plan advocated by Rutherford Morison.

After removal of the pylorus, the stomach opening is larger than the duodenal. An incision over 1 inch in length is made down the centre of the anterior wall of the duodenum. By spreading this longitudinal cut transversely the duodenal opening is so widened as to correspond in size with the stomach opening. The two viscera are now united. The posterior wall of the opening which is to serve as the artificial pylorus is first made. A long catgut suture threaded in an ordinary needle is introduced through all the coats in the position of one of the outer three temporary sutures used to show the exact relation of parts. This suture is securely tied, has its short end clamped in hæmostatic forceps, and takes the place of the temporary suture. The longer threaded end is used as a continuous stitch through all the coats of the stomach and duodenum, and brings their apposed surfaces into firm apposition. The middle tem-

porary suture being reached, it is withdrawn, and the continuous stitch travels on to the further temporary one, which it replaces.

The posterior wall is now formed by a continuous catgut suture passed from within outwards through all the coats, and bringing the peritoneal surfaces of stomach and duodenum into firm apposition. The anterior wall is next made in a similar way by a continuous catgut stitch through all the coats, but here the suture cannot be passed from within, and of course does not bring the peritoneal coats into appo-

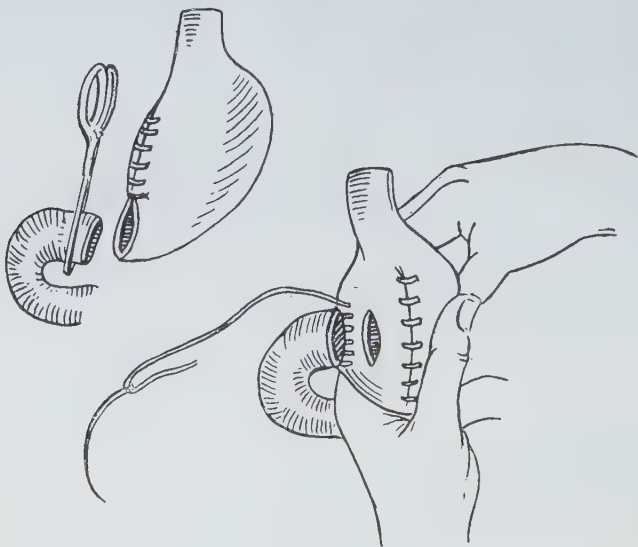


FIG. 64.—PARTIAL GASTRECTOMY. (KOCHER'S OPERATION.)

sition as it does posteriorly. The object of this continuous catgut stitch is to secure a temporary watertight junction between the two viscera. To secure broad permanent adhesion between stomach and duodenum, a ring of fine silk interrupted sutures through peritoneal and muscular coats only is placed all round the temporary junction effected, and completely buries it.

2. **Kocher's Method.**—Suture of the stomach incision; implantation of the cut end of the duodenum into the posterior wall of the stomach. The union may be effected by a simple

suture, bobbin or button. The suture adopted by Kocher is most satisfactory. Kocher has recorded fifty-seven cases operated upon by this method, with five deaths. Although the Murphy button has been frequently advocated and employed; we feel strongly that by its use there is no saving of time worth the mentioning, and the risks are decidedly grave.

The duodenal cut end may be implanted into the anterior wall of the stomach. Czerny has used both the anterior and the posterior methods, with and without the Murphy button, but does not express any preference for one over the others.

Continuous sutures (catgut for the mucous membrane and silk or Pagenstecher thread for the serous surfaces) with one or more interruptions are employed, as in gastro-enterostomy.

The details of the operation are as follows: An incision 4 or 5 inches in length is made in the middle line, more or less above the umbilicus, according to the position of the pylorus. After opening the abdomen, the tumour is examined carefully to determine the limits of its infiltration. Small openings are made in the greater and lesser omenta wide of the growth, to enable the clamps to be introduced. The omenta are then ligatured; if any vessels are torn, they are at once secured. When the tumour is thus isolated it is everywhere surrounded with sterile compresses. The stomach is then clamped with two Kocher's clamps, one above, the other below. The duodenum is closed with one clamp close to the growth, and a second at a distance of 1 inch, and the gut is divided between them. The cut surface is cleansed by mopping with 1 in 1,000 sublimate solution, and now, and throughout the operation, care is taken to avoid soiling by the secretions of the stomach or intestine. The proximal end of the duodenum is wrapped in sterile gauze and drawn out of the wound. An assistant now grasps the stomach from above and below between the thumb and the index-finger, and the stomach is divided between his fingers and the clamps. The cut end is dried, and any secretion which escapes is carefully mopped up. The bleeding vessels are ligatured. A continuous suture now closes the stomach incision, and includes all the coats. A second continuous Lembert suture is applied, including only the peritoneum.

The assistant now seizes the stomach, and by pressure with the thumbs makes the posterior surface present to the front. The duodenal cut end is then applied to the posterior surface of the stomach, and a continuous silk suture unites its serous coat along the whole length of the posterior half to the presenting surface of the stomach. The duodenal clamp is now removed. The stomach is incised in front of the continuous suture along a distance equal to the breadth of the duodenum. After bleeding is arrested, a continuous suture unites the cut margins of the stomach and duodenum and includes all the coats, or one suture unites the muscular and another the mucous surface. The anterior borders of the openings are now united in the same manner as the posterior. The parts are cleansed and replaced and the compresses removed. Kocher lays stress upon three points: (1) Rigorous asepsis; (2) the employment of continuous sutures throughout; (3) the use of good clamps. He advises the use of the Murphy button when there is any tension owing to an inability to drag the duodenum forward. There is rarely any difficulty in securing easy apposition of the duodenum and stomach, for the latter has a remarkably free range of movement, and can be very easily pulled across to the duodenum. Kocher himself has removed the stomach to within two fingers' breadth of the cardia, and yet secured an apposition free from strain. An extension towards the duodenum entailing a free removal would furnish the chief difficulty to this procedure.

3. **Closure of both Cut Ends—Performance of Gastro-enterostomy.**—After removing the growth, the cut ends of the stomach and duodenum are completely closed by continuous sutures, of catgut for the mucous membrane or all the coats, and of silk for the serous surface. An anastomosis is then made between the stomach and the jejunum in one of the methods already described, the posterior method being that most commonly employed. The order of the operations may be reversed, as advised by Tupolske and Czerny, the gastro-enterostomy being first performed, and, after the lapse of two weeks or thereabouts, the pylorectomy. This has the advantage of lessening the demand made upon the patient's powers,

and of enabling some strength to be gained by careful dieting in the interval. The following is an example :

HOURLY-STOMACH CAUSED BY CYLINDER OF CANCER IN THE CENTRE. GASTRO-ENTEROSTOMY WITH SUBSEQUENT PARTIAL GASTRECTOMY ; RECOVERY.

Mr. B., aged sixty-two, was sent to one of us—Mayo Robson—by Dr. James Gardner, of Burnley, Lancashire, suffering from a movable tumour, thought to be cancer of the stomach, which had been noticed for a month, but which had been preceded by stomach symptoms, chiefly pain after food and slight vomiting, for quite a year. There had latterly been some slight coffee-ground vomit, but no large amount of blood had been vomited at any time. The tumour was not tender, and could be pushed up under the left, and moved over to the right, costal margin. A stomach splash was well marked on the left of the tumour, and on distending the stomach with CO₂ the lump was pushed over to the right. The vomit was acid from the presence of lactic acid, but no free HCl could be found.

Pylorotomy was advised, and the patient was admitted to the infirmary, being then in an extremely weak condition.

November 15, 1900.—On opening the abdomen a mass of growth was found in the centre of the stomach, forming a ring of cancer, and leaving a cavity on its proximal and distal sides, the cardiac cavity forming the dilated stomach where the splash on succussion was felt. Dr. Seaton, who was giving the anæsthetic, advised that the patient was too feeble to bear a prolonged operation, and a colleague also confirmed the fact that the pulse could be barely felt at the wrist. A posterior gastro-enterostomy was therefore performed, a bone bobbin being employed.

He soon rallied and made a good recovery, gaining flesh and weight, and expressing himself as very well.

December 20.—The radical operation of removing the growth by partial gastrectomy was performed, about half the stomach being removed in order to leave a wide margin of healthy tissue between the growth and the wound.

Union was effected by suturing the cardiac and pyloric incision together over a bone bobbin, catgut being used for the mucous and celluloid thread for the serous sutures, the whole operation being completed within the hour. No glands were felt beyond the resected area. Recovery was uninterrupted, and he returned home within the month, eating and enjoying food, and having gained considerably in weight.

April, 1901.—He continues well and active, and has been able to resume his work.

Partial Gastrectomy for Cancer of the Body of the Stomach.

The ideal operation for pyloric growth involves the removal of so much of the stomach wall that it may be properly called partial gastrectomy. There are, however, cases of mural cancer in which local excision is necessary. For example, an hour-glass contraction of the stomach may be caused by a thick ring of growth, like a napkin-ring, in or near the middle of the stomach. In such a case the growth may be removed, and the cut edges of the stomach united.

The vessels in the small and large omentum are ligatured and divided. The stomach being clamped on each side by a Doyen's or Kocher's clamp, the growth and a wide area of seeming healthy wall around it are removed. The minimum distance between the line of section and the margin of the growth must be 3 centimetres. Mikulicz lays emphasis upon the fact that the frequency of local recurrence shows that too little of the stomach is generally removed. The lymphatic glands along the whole length of the lesser curvature are removed with or without the stomach wall along which they lie. If any are found in the great omentum or along the greater curvature, they also must be removed. Union of the divided ends may be effected by the simple continuous suture, as in gastro-enterostomy, or by the largest bone bobbin, preferably the latter, as in the following cases :

**CANCER ; HOUR-GLASS STOMACH. PARTIAL GASTRECTOMY ;
RECOVERY.**

Mrs. J. was sent to one of us (Mayo Robson) by Dr. Forster of Dalton in Furness, January 24, 1901, with a movable tumour in the epigastrium that had been noticed three weeks previously. There had been no vomiting, although indigestion, pain an hour after food, and loss of flesh and strength, had been noticed since August, 1899.

She weighed 7 stones, having weighed 8 stones or more previous to her illness. The tumour appeared to be the size of a tennis ball, was free from tenderness, and could be made to move across the abdomen from one side of the umbilicus to the other.

On distending the stomach with CO₂, it reached nearly to the

pubes on the left side, but very little distension was noticed on the right, beyond the tumour. She was admitted to the infirmary, and on January 31, on exposing the stomach, a tumour was found involving the whole circumference a short distance from the pyloric end, so that between the pylorus and the tumour a small second stomach cavity existed, the dilatation being formed entirely by the cardiac complement. The tumour was completely excised, and the distal and proximal portions united over a bone bobbin. Glands were removed from the lesser and greater omentum. Recovery was uninterrupted, and the patient left the hospital before the month end, having regained the weight lost during the week after operation, and having added $\frac{1}{2}$ pound over. The tumour proved to be cancer.

PARTIAL GASTRECTOMY, CHOLECYSTECTOMY, AND PARTIAL
HEPATECTOMY FOR CANCER; RECOVERY.

Mrs. S., aged fifty-four, was sent to one of us (Mayo Robson) by Dr. Fry of Haworth, on July 28, 1900. The previous history was rather indefinite, as the patient did not think it necessary to seek medical advice before the previous April. She said that she had been in excellent health until November, 1898, when she began to suffer for a month or six weeks from spasmodic pains over the gall-bladder region, but she was never jaundiced after the attacks. She also had pain at the epigastrium like indigestion. When Dr. Fry saw her she was suffering from a severe attack of pain in the right hypochondrium with vomiting, and was in a state of general collapse. Her general condition was then unsatisfactory, as she had lost considerably in weight, and was evidently in failing health, there being some slight swelling of the legs and general distension of the abdomen. The skin was sallow, with a slight tinge of jaundice; the liver was found to be enlarged, and the gall-bladder could be felt as a hard mass, well defined, about 2 inches wide and 3 inches long. It was tender on pressure, and was painful after any exertion.

In June and July the swelling gradually increased, and the mass extended over a larger area approaching nearer to the umbilicus, and later a sensation of fluctuation was felt, when the deep swelling became less definite, but the surface swelling was more obvious on inspection. About the middle of July there was a sudden decrease in the size of the tumour, with some relief and temporary improvement. It was at that time that we saw her, and found a distinct tumour beneath the right costal margin, apparently adherent to the parietes. Cholelithiasis with suppuration was diagnosed, and the question of malignant disease raised.

The stomach was markedly dilated. On August 9 a vertical incision through the right rectus was made on a mass of adherent viscera. An abscess was found in the sheath of the rectus, which was cleared out and purified as far as possible. The gall-bladder, which was very much thickened and adherent, was opened, when some thick purulent discharge escaped. General soiling of the peritoneum was prevented by sponge packing. A large gall-stone was removed from the gall-bladder, and another from the cystic duct. A fistula was found between the gall-bladder and the pyloric end of the stomach, through which the empyema was discharging itself into the stomach.

The pylorus was found to be much thickened and the seat of a nodular growth, which also involved the gall-bladder and adjoining part of the liver. Cholecystectomy was performed, and with the gall-bladder was removed a V-shaped portion of the liver, the gaping edges in the liver being brought together by deep chromicized catgut ligatures, the hæmorrhage being controlled by sponge pressure. A tube was placed in the cystic duct, which was then firmly stitched round the tube, so as to avoid the escape of bile. Partial gastrectomy was then performed, the cut section of the stomach being united to the cut section of the duodenum by means of two continuous sutures around a bone bobbin. An omental graft was then sewn over the junction to afford additional security. As the disease was clearly malignant and all the growth within the abdomen had been removed, the portion of rectus involved in the disease and the adjoining peritoneum were excised, a further transverse incision being necessary. To close the wound the peritoneum, aponeurosis, and muscular wall were then securely closed layer by layer, the whole operation being completed within the hour.

The patient rallied well, and convalescence was uninterrupted. Bile flowed freely through the tube until it was removed on August 22; a gauze drain was then employed until the wound healed. The fæces soon assumed a normal colour, and the slight jaundice cleared up. Microscopic section of the growth showed it to be columnar-celled carcinoma. The patient returned home within the month, and when she came to see us two months after operation she was then gaining strength, and had had no return of her symptoms. The general health had much improved, and, beyond a slight sinus where the drainage-tube had been and the scar of the wound, there was no trace of operation. The small sinus did not discharge bile, but merely a few drops of sero-pus in the day.

A report from her medical man in March, 1901, was to the effect that the patient was in very good health.

Preliminary Ligature of the Coronary and Gastro-duodenal Arteries.

Cunéo (*Thèse de Paris*, 1900) draws attention to the advantages which result from a preliminary ligature of these vessels. Ligature of the coronary artery permits the easier application of a clamp to the stomach. Ligature of the gastro-duodenal is effected after division of the stomach at its duodenal end. The cut ends of the viscera are forcibly drawn apart, and the vessel is seen to occupy the depth of this angle formed by the meeting of the duodenum and the pancreas (*sinus duodeno-pancreaticus*). After ligature of the vessel the subpyloric and retropyloric glands are dissected out from a bloodless area.

Complete Gastrectomy.

This operation was first performed in 1883 by Connor of Cincinnati. His patient, a woman of fifty years of age, died on the table. In 1894 Langenbuch published two cases of 'resection of the stomach;' in each only seven-eighths, not the whole of the stomach, was removed. The first complete gastrectomy in the human subject was performed by Schlatter of Zurich on September 6, 1897; the second by C. B. Brigham, of Boston, U.S.A., on February 24, 1898. In the former the cut end of the œsophagus was united to a loop of the jejunum, the duodenal opening being closed; in the latter the cut ends of the œsophagus and duodenum were united over a Murphy's button.

The following account is taken from Dr. Schlatter's description (*Lancet*, vol. i., 1898) of the operation performed by him:

'After shutting off the peritoneal cavity with sterilized compresses, I isolated the stomach on its great and small curvatures, separating the great and small omentum with the aid of Péan's clamps, and ligaturing the clamped portions with silk. I then pulled it firmly downwards in order to obtain access to the œsophagus. The left lobe of the liver, which covered the field of operation, was held up constantly by the hand of an assistant, in which way we succeeded in applying a Wölfler's compressorium

to the œsophagus tolerably high up. I applied a Stille's clamp quite close to the cardiac border of the tumour, and separated the stomach from the œsophagus just at their point of junction. The direction of the incision happened to be somewhat oblique, so that I found it to be advantageous to reduce the aperture of the œsophagus by means of a small suture. The pylorus was treated in exactly the same way. The duodenum was freed as far as possible towards the head of the pancreas, and the stomach, together with the pylorus, was separated between a "duodenum compressorium" applied as far away as possible, and a tumour compressorium applied to the duodenal region. The aperture of the portion of the duodenum which remained in the abdomen was cleansed with pads of iodoform gauze, just as had been already done in the case of the aperture of the œsophagus. An extensive portion on the continuity of the digestive tract was now cut away. I endeavoured to draw up the end of the duodenum to the end of the œsophagus, but it was only with the greatest difficulty that I could bring them into contact, so that the union of the two orifices was not to be expected. I turned in the border of the duodenum, and closed the aperture with a double suture. Starting from the duodeno-jejunal angle, I followed the small intestine downwards for about 30 centimetres (12 inches), drew it out at that point, brought it across the transverse colon, and applied it to the end of the œsophagus. A piece of the small intestine about 10 centimetres (4 inches) long being held in Wölfler's compressors, the intestine was fixed to the œsophagus by suturing the serous membrane, after which it was incised for about $1\frac{1}{2}$ centimetres (0·6 inch) in the direction of its length, and the mucous membrane of the œsophageal part was united in its whole circumference with the mucous membrane of the intestine by means of a continuous circular silk suture. A continuous suture in the muscular and serous tissue and a Lembert's interrupted silk suture were applied over the suture of the mucous tissue. The compressors on the small intestine, as well as the one in the extremity of the œsophagus, which latter had been in position more than two hours, were removed. When returned to the peritoneal cavity, the sutured parts retracted themselves upwards with some force to the place where the œsophagus traverses the diaphragm. The abdominal walls were closed. The anæsthesia (8 fluid ounces of ether) progressed quietly. The pulse after the operation was regular, tolerably full, and 96 per minute.'

The patient recovered from the operation, and lived until October 29, 1898. At the autopsy the mesenteric, retroperitoneal, bronchial and supraclavicular lymphatic glands were found enlarged, and secondary deposits were found in the pleuræ.

The following is an abstract of Brigham's case :

On opening the abdomen the tumour was found to comprise nearly half of the wall of the stomach ; there was no marked glandular involvement or adhesions, and it was decided to remove the whole organ. The greater and lesser omenta were tied off and divided, the duodenum was clamped, and a ligature was placed around it $\frac{1}{2}$ inch above the clamp, and the tissues were divided between the two. The ends were washed in salt solution and wrapped in iodoform gauze. The same method was employed with the œsophagus and the cardiac end of the stomach. It was found that the œsophagus and duodenum could be brought together, and they were united by a Murphy button to shorten the operation, as the patient was growing weak. No Lembert sutures were used, as the approximation was good. The operation lasted two and a quarter hours, and was followed by considerable shock. At the end of six weeks, when the report of the case was made, the patient was quite well, enjoyed her food, and was gaining in weight. Never after the operation was any undigested food found in the fæces.

These cases illustrate the two possible methods of dealing with the cut ends of the œsophagus and duodenum after the stomach has been excised. The method employed by Brigham is theoretically the better, for when an end-to-side anastomosis is performed, food might conceivably pass from the œsophagus into the proximal part of the jejunum, and, there permanently lodging, set up ulceration and perforations.

Results of Partial Gastrectomy.

We do not think that any useful purpose can be served by quoting the statistics of the earlier cases of pylorotomy. The mortality was enormous ; the experience gained, however, was invaluable. In order to obtain a fair estimate of the risks and successes of an operation so rarely performed, it is essential that we should select only those operators who publish all their cases, ignoring the isolated successful cases recorded from time to time in the journals. The Continental surgeons chiefly afford us the information necessary.

Krönlein (*Archiv. f. Klin. Chir.*, 1898, p. 447) records all his cases of partial excision, and his assistant Schlatter's

case of total extirpation, of the stomach. Of 24 cases, 5 died; of the first 4 resections 3 died (1881-1888), of the following 20 only 2 died (1888-1898). The after-history of the 19 patients who recovered is as follows: 2 died of intercurrent disease (heart failure, pneumonia) within four months, without recurrence; 8 died of recurrent growth, 2 in the first year, 4 in the second year, and 2 in the third year. The average duration of life in these 8 cases was 507 days. Eight patients were alive in July, 1898, without recurrence; 6 in the first year and 2 in the fourth year; 1 case was living with a recurrent growth (Schlatter's case died thirteen and a half months after operation).

Maydl (*Medical Press*, October, 1899) records 25 operations for carcinoma of the stomach; 4 patients died, directly or indirectly, as the result of the operation in two, three, and five days, and from embolic gangrene of right leg; 7 patients recovered from the operation and left the hospital, but suffered from a return of the growth within a short period. The average duration of life was 11.7 months. Fourteen patients were alive at the time of the report; of these, 7 had lived for over two years, averaging four years two and a half months each, and 7 had lived for under two years.

Kocher (*Korrespondenzblatt für Schweizer Aerzte*, 1898) has resected the pyloric end of the stomach 57 times, with 5 deaths. Eight cases are considered as cured. One, a woman, was alive ten years after operation, another five years, another three years, another two and a half years. Four patients died over three years after the operation from other causes.

Rydygier (*Deut. Zeitschr. für Chirurgie*, January, 1901) relates all the stomach operations he has performed in the last twenty years. There are 25 partial gastrectomies. Of these, 8 recovered and 17 died. The causes of death are: Pneumonia, 5 cases; septic peritonitis, 2 cases; shock and collapse, 5 cases; in 5 the cause is not stated. Rydygier resects a large portion of the stomach for limited tumour, cutting at least 5 to 10 centimetres beyond the apparent confines of the growth.

Czerny (*Beitr. zur Klin. Chir.*, 1899, p. 18, and *Archiv.*

f. Klin. Chir., 1898, p. 459) has performed 29 partial gastrectomies since 1881. Of these 11 died. Of the survivors, one has lived 7 years, one $3\frac{1}{2}$ years, and in others life was prolonged from 3 to 31 months. The average duration of life after operation was 22 months.

Mr. Rutherford Morison, of Newcastle, has kindly favoured us with the details of all his cases of partial gastrectomy. There are 16 cases. Of these, 7 died within a month of operation—4 days, 14 days, a few hours, 6 days, 29 hours, 8 days, and 14 hours; 9 recovered from the operation, and lived 7 weeks, 37 months, 26 months, 19 months, 6 months, 2 months, and 7 months; 2 are still living without recurrence: 1 was operated upon in October, 1898, and 1 in October, 1900.

Results of Complete Gastrectomy.

Twelve cases of complete gastrectomy have been recorded, with the following results:

1. The patient died on the table. (Connor.)
2. Lived 14 months. (Schlatter.)
3. Alive and well 2 years after operation. (Brigham.)
4. Alive and well 17 months after operation. (Delaunoy.)
5. Died 11 months after of recurrence. (Richardson.)
6. Alive and well 18 months after operation. (Macdonald.)
7. Death. (Chavasse.)
8. Death on the table. (Noble.)
9. Died 36 hours after operation. (Bernays.)
10. Stomach, first portion of duodenum and a portion of pancreas removed. Patient alive 11 months after operation. (Ricord.)
11. Recovery. Recently performed. (Boeckel.)
12. Recovery. Recently performed. (Harvie.)

Thus, of 12 patients, 4 died as a result of the operation. Of those that survived, the earliest death was 11 months after operation. The cases are too recent for any pronounced opinion to be passed, but the results may, we consider, be looked upon as surprisingly good and as a happy augury for future extensive and radical measures.

Jejunostomy.

Jejunostomy is an operation that can be but rarely called for. It is suitable only for those patients suffering from advanced disease, in whom, owing to the position, or extent, or character of the growth, gastro-enterostomy is deemed imprudent or impossible. Maydl has recorded 22 cases, with 4 deaths, as the result of the operation. His method is as follows: The abdomen being opened, the upper part of the jejunum is sought. When found it is divided completely, the proximal end stitched to the side of the distal, and the distal brought up to the abdominal wall. Probably a safer, certainly a quicker, operation would be one (performed on one occasion by Moynihan, *Lancet*, April 27, 1901) planned after the method of Witzel for gastrostomy. The upper portion of the jejunum being exposed, by an incision through the left rectus muscle a small incision is made in the gut and an indiarubber tube equal to a No. 10 or 12 catheter fixed in by a single stitch. The tube is then enfolded on the wall of the intestine towards the duodenum and buried by a layer of sutures. A few additional sutures secure the jejunum to the abdominal wall, and the wound is finally closed round the tube. The patient can be fed immediately.

Although the operation is so rarely called for, it is, nevertheless, one that should be borne in mind, as in an appropriate case it confers a great boon upon the patient, and renders tolerable an otherwise comfortless existence. Schlatter's case of œsophago-jejunostomy after total resection of the stomach showed that a patient could thrive and increase in weight upon food which was introduced into the intestine at almost the same point as in jejunostomy, performed by the above method. The following is an account of a case operated upon by Mayo Robson in 1891:

EXTENSIVE CANCER OF STOMACH, WITH INABILITY TO RETAIN FOOD. JEJUNOSTOMY; RECOVERY FROM OPERATION; DEATH FROM PROGRESS OF DISEASE AT END OF TWO MONTHS.

Mrs. E. B., aged fifty-eight, residing in Lincolnshire, was sent on June 19, 1891, by Dr. Hamilton of Crowle, on account of an abdominal tumour, accompanied by persistent vomiting and rapid

loss of flesh. The patient said that she had been quite well until a year and a half before admission, when she was suddenly attacked with vomiting, which had continued ever since. She had lost weight from that time, until on admission she was worn almost to a skeleton. She had never had hæmatemesis. The vomiting took place directly after food, and was unaccompanied by nausea. At the beginning she had a stabbing pain after food in the region of the left breast, but during the six months before admission the pain had been continuous, and always worse after eating. About three months before admission she first noticed a swelling in the left hypochondrium, which had increased rapidly up to the time of admission. From the time the tumour was noticed the pain always seemed to radiate from it.

On admission the patient was extremely emaciated, and vomited everything immediately after eating. The vomit consisted simply of what she had taken, and contained free hydrochloric acid, but no sarcinæ or blood cells could be detected microscopically. Occupying the left hypochondrium, and reaching into the epigastrium, was a hard nodular tumour, moving up and down with respiration, the skin being quite movable over it. A tumour could also be felt beneath the liver, which was diagnosed as a distended gall-bladder.

Cancer of the stomach was diagnosed, and the patient was fed with small quantities of Brand's essence and peptonized foods, nutrient enemata being also administered. The pain was controlled by morphia.

At first slight improvement took place, but towards the end of the month she again lost ground, and the vomiting still persisted. After consultation, an exploratory incision was decided on, in order to see if the disease could be removed; but if it should prove too extensive for removal, as it was suspected it might, jejunostomy could be done.

On July 1, 1891, the A.C.E. mixture being the anæsthetic and the skin of the abdomen having been aseptitized, an incision of 3 inches was made in the linea alba above the umbilicus, exposing the tumour, which was found to be occupying the whole of the anterior wall of the stomach, and therefore incapable of removal. There was also a distended gall-bladder, containing gall-stones.

The jejunum was then found at its fixed point on the left of the spine, and traced for about 6 inches downwards, at which spot a knuckle of the bowel was brought forward and fixed by loop sutures (after the parietal peritoneum and skin had been connected by a continuous suture), in the way suggested for gastrostomy by Mr. Greig Smith, and which a case of ours

published in the *British Medical Journal* for June 7, 1890, proves to be a safe and efficient method.

A loop of silver wire was first inserted into the convex surface of the bowel at a spot where it would have to be opened. A round, large-eyed sewing needle was then threaded with 12 inches of silk of medium thickness, and passed under the peritoneal coat of the intestine in a circle about $1\frac{1}{2}$ inches in diameter, the suture being made to emerge and leave five loops at equal intervals. The loops were drawn through the parietes at about $\frac{1}{8}$ inch from the margin of the wound. As each loop was drawn up, a piece of No. 6 catheter was passed through it, and when all were in position the ends of the silk were drawn in and the loops tightened over the catheter, over which the two ends were then knotted; the silver wire was then fixed under the catheter, and a few sutures connected the bowel to the skin. The rest of the parietal incision was brought together by interrupted silkworm-gut sutures in the ordinary way.

On the following day the patient felt quite comfortable, and was fed by the rectum entirely. This was continued until July 7, when a small opening was made in the exposed bowel with a tenotomy knife, and a soft catheter was passed in, through which she was fed by peptonized food, of which she was able to take two or three pints a day. She gained flesh, and was able to return home on July 27. Her chief trouble was that the skin around the artificial opening became irritable; but through the opening into the duodenum she continued to be able to take a fair quantity of food, which was well retained. The original disease continued to advance, and after two months she died from exhaustion.

No autopsy could be obtained.

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THE END

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